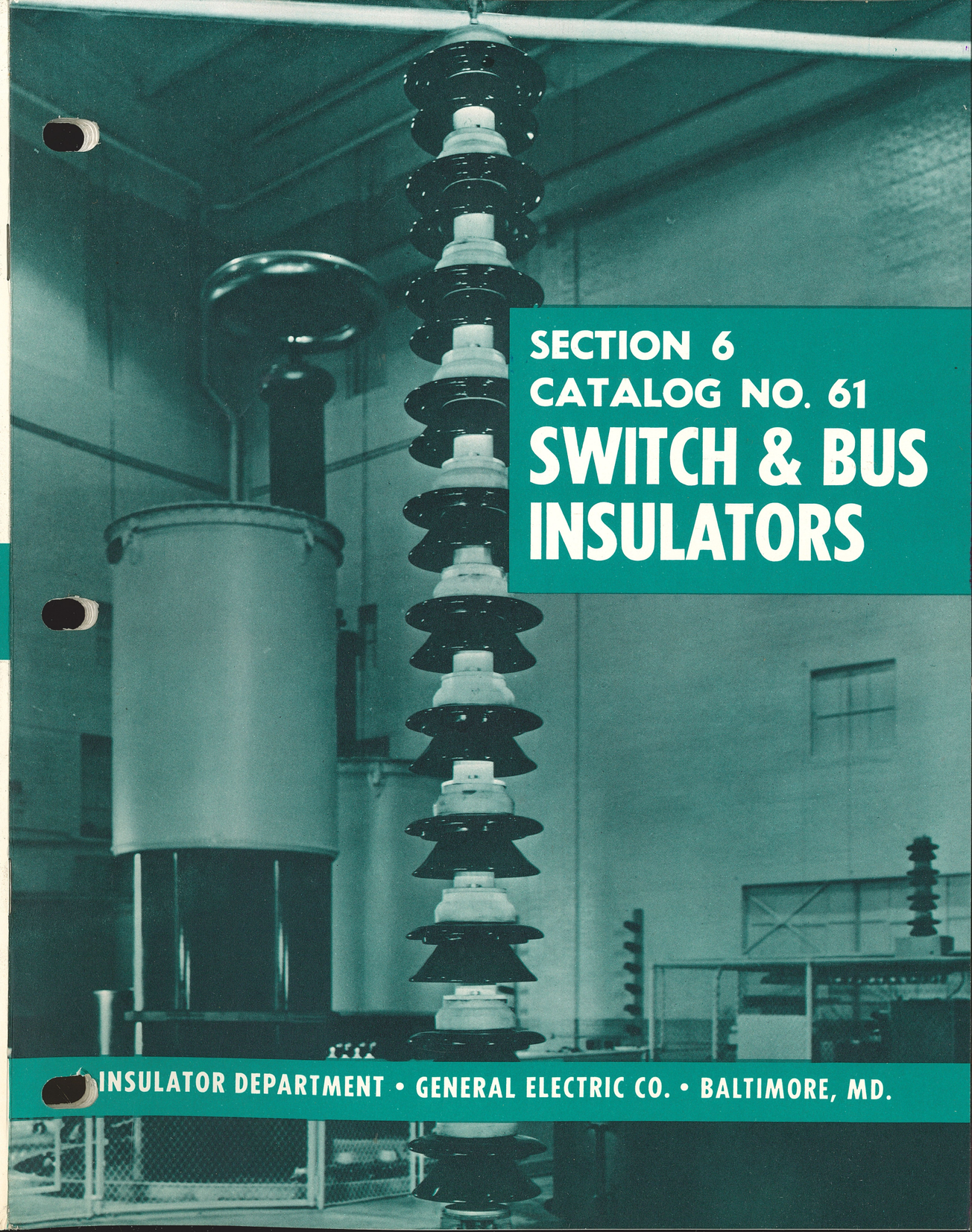
INSULATOR DEPARTMENT

GENERAL ELECTRIC

BALTIMORE, MARYLAND

TIA-187-6 (10M) 12-61



SECTION 6

CATALOG NO. 61

SWITCH & BUS INSULATORS

INSULATOR DEPARTMENT • GENERAL ELECTRIC CO. • BALTIMORE, MD.

SWITCH AND BUS
TABLE OF CONTENTS

TABLE OF CONTENTS

GENERAL INFORMATION	Page
Construction details	1, 2
Stacking and non-stacking units	2
Apparatus connections	2
Mounting details	2
Application information	2, 3, 4
Basic impulse insulation levels	4

CAP AND PIN TYPE	
General information	5
Cantilever strength	6, 7
Voltage rating index	7
Standard strength, 7.5KV-69KV	8, 9
High strength, 7.5KV-69KV	10, 11
Units for special applications	12, 13
Stacking units, 350 BIL- 750 BIL	14, 15
900 BIL-1300 BIL	16, 17
1470 BIL-1800 BIL	18, 19

STATION POST TYPE	Page
General information	20, 21, 22
Cantilever strength	23
Voltage rating index	23
Standard strength, 7.5KV-69KV	24, 25
High strength, 7.5KV-69KV	26, 27
Extra high strength, 7.5KV-34.5KV	26, 27

STACKING POST TYPE	
Standard strength, 550 BIL-1050 BIL	22, 28, 29, 34
High strength, 550 BIL-1470 BIL	22, 30, 31, 34
Extra high strength, 650 BIL-1470 BIL	22, 32, 33, 34

OUTDOOR BUS CLAMPS AND FITTINGS	
General information	36
Outdoor bus clamps	37, 38, 39
Adapters and spacers	40

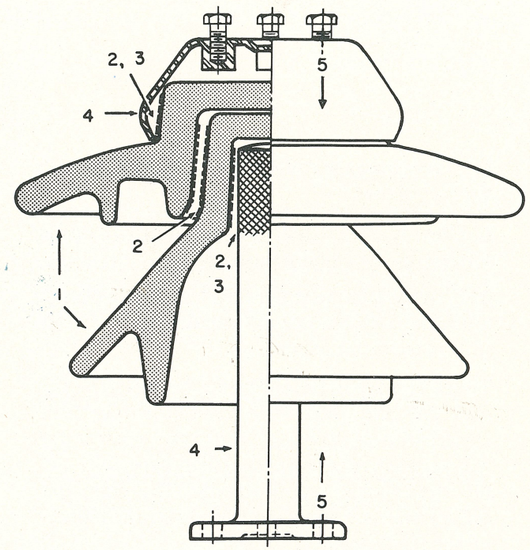
COMPARATIVE CATALOG NUMBERS

NUMERICAL INDEX

Catalog Number	Page
7785	10, 11, 14-19
7791	40
8888	12, 13
23082	14-19
23083	14-19
23333	14-19
27423	40
29007-29069	
29153	8, 9
29200	8, 9
29250	8, 9
29251	8, 9
29455	8, 9
29511	8, 9, 14, 15
29710-29750	28, 29
29810-29850	28, 29
30007-30069	26, 27
30153	10, 11, 14, 15
30200	10, 11
30250	10, 11
30251	10, 11
30455	10, 11
30710-30770	30, 31
30810-30870	30, 31
31007-31034	26, 27
31444	14-19
31720-31770	32, 33
31820-31870	32, 33
32200	12, 13
1883588	40
6026203	40
6026206	37
6026215	40
6052744	37
6129744	38
6129746	38
6129747	38
6159600	39
6159601	39
6159602	39
6159603	39
6159604	39
6159605	39
6159606	39
6159607	39
6179647	40
6187174	38

Cover Photo: 1925 BIL stack of extra high strength 31444 insulators prepared for tests in the Fred M. Locke high voltage laboratory.

INSULATORS
GENERAL INFORMATION



Locke* switch and bus insulators, available as cap and pin or post type, are designed and manufactured to give long life and trouble free service. Seldom do we think of insulators in terms of a fourth dimension, time, but this is a very definite concept incorporated in the design and manufacture of all Locke insulators and demonstrated by years of dependable performance. Locke switch insulators installed over forty years ago are still in service on high voltage lines. Locke insulators are manufactured from the most carefully selected raw materials to provide the highest quality electrical porcelain. Some 77 quality and inspection operations throughout the manufacturing process assure uniformly high mechanical and electrical strength in all Locke insulators.

CONSTRUCTION DETAILS

1. Proven design and manufacturing techniques provide finest quality porcelain, compression glazed, to give high mechanical and electrical strength.

2. Assembly of hardware and porcelain components is made with neat Portland Cement, steam cured under controlled conditions to achieve optimum physical properties. Special sanded surfaces, developed by engineering research, provide reliable gripping areas on the porcelains to develop the full strength of the assemblies.

3. To relieve thermal stresses and assist in the distribution of working loads between stressed members, a permanently flexible coating is applied to the hardware components, separating the metal and cement. This coating also prevents any chemical reaction between cement and hardware.

4. The insulator caps and pins are made from the finest malleable iron or low carbon steel. All hardware is double hot dip galvanized providing a sound uniform zinc layer on all metal surfaces. Galvanizing exceeds requirements established under ASTM specifications.

5. All insulators are jig assembled to assure proper alignment of bolt holes, uniform height and parallel mounting surfaces.

Functionally, a switch or bus insulator must fulfill certain basic requirements:

a. Support the required mechanical loads in cantilever, torsion, tension, and compression.

*Trademark of the General Electric Co.

SWITCH AND BUS GENERAL

b. Have adequate dielectric strength to prevent puncture.

c. Provide a sufficient air gap to give the required flashover characteristics.

d. Provide sufficient surface leakage to permit operations under normal conditions of atmospheric contamination.

There is very little difference between the cap and pin and post type insulators in their electrical and mechanical characteristics for comparable ratings and either type will fulfill the above requirements. The principal differences are found in the design and shape of the insulators.

STACKING AND NON-STACKING UNITS

Switch and bus insulators are divided into stacking and non-stacking units. Stacking units are designed to develop higher cantilever strength and greater rigidity when used in tall stacks.

Conventional cap and pin standard units rated up through 46 KV are non-stacking. Post insulators rated through 69 KV are non-stacking.

APPARATUS CONNECTIONS

When conductor connections are made between switch and bus insulators connected to heavy apparatus, such as transformer or circuit breaker bushings, sufficient flexibility and slack should be provided to allow for differential settling of structures and thermal changes.

MOUNTING DETAILS

Mounting holes in hardware are drilled on 3″, 5″, or 7″ diameter bolt circles. Threaded holes are tapped 0.010″ oversize so that standard galvanized steel bolts or standard non-ferrous bolts may be used.

APPLICATION INFORMATION

RADIO INFLUENCE VALUES

The radio influence values in the tables apply only to new switch and bus insulators tested in the factory, and are the maximum permissable microvolt ratings when tested at the indicated test voltage to ground. Tests are made in accordance with current NEMA-EEI-RMA recommendations on methods of measuring radio noise, ASA C-29.1-1961, or latest revision. The low frequency RMS test voltage values are approximately 10% higher than the line to ground voltage at which these insulators are usually operated. In apparatus applications, the limits for these insulators will be established by the standards of the apparatus.

INSULATORS INFORMATION

APPLICATION INFORMATION (CONT.)

HIGH RESISTANCE COATINGS

Locke cap and pin type switch and bus insulators comply with ASA standards for radio noise free insulators. The elimination of radio noise on some types of switch and bus insulators calls for a semi-conducting layer on the porcelain surface. This is accomplished by the use of Metaglaze which contains metallic oxides in precise proportion, to obtain specific high-resistance properties. This glaze is applied on the desired areas only, under the regular glaze. The pyro-chemical reactions of firing cause thorough bonding and result in superior radio-influence characteristics unaffected by exposure, chemical fumes, abrasion, even sandblasting of portions of the conducting area. Here too, glaze thickness control is essential, as resistivity varies with glaze thickness. Automatic glazing machines safeguard this important element of insulator quality.

TOLERANCES

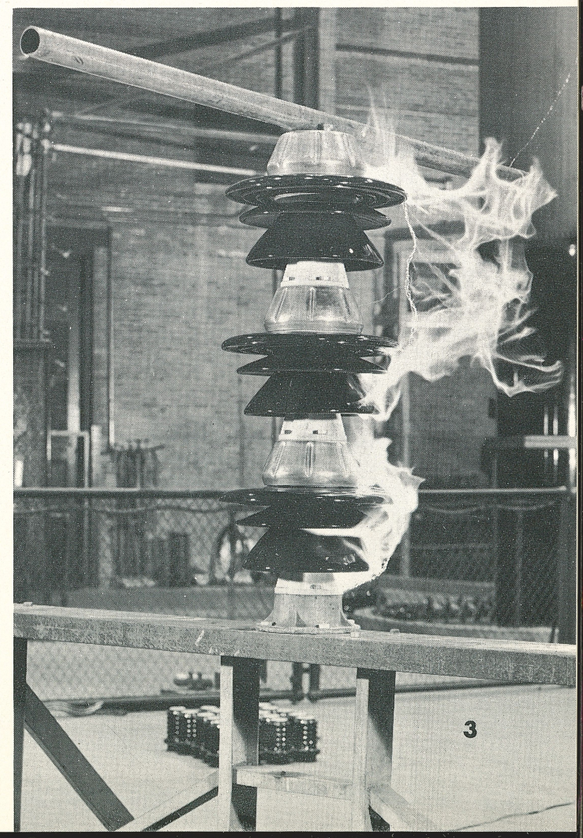
Mechanical strength and flashover ratings are average values and are subject to the tolerances specified in the latest ASA standard. Plus or minus 3% manufacturing tolerance on all dimensions except height. Height tolerance is plus or minus 1/32″. Plus or minus 5% manufacturing tolerance on weight.

CHARACTERISTICS

Tests are conducted in accordance with ASA C-29.1-1961 or latest revision. Flashover and withstand ratings on cap and pin types include the use of subbases with the insulators, if they are commonly used to develop full electrical values.

TECHNICAL REFERENCE NUMBER

The Technical Reference Number (T.R. No.) is an ASA identification for an insulator unit or stack with prescribed characteristics.



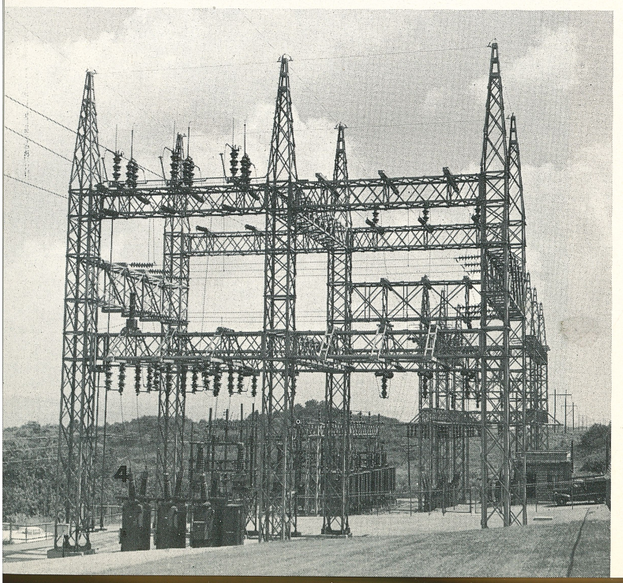
Dry Flashover Test of Switch Insulators in High Voltage Lab.

SWITCH AND BUS
GENERAL INFORMATION

APPLICATION INFORMATION (CONT.)

BASIC IMPULSE INSULATION LEVEL

A basic insulation level (BIL) is the impulse voltage which electrical equipment is required to withstand without failure or disruptive discharge, when tested under specified conditions of temperature and humidity. Basic impulse insulation levels are designated in terms of the crest voltage of a 1.5 x 40 microsecond full wave impulse voltage test wave. These levels are subject to continuing study by a joint AIEE-EEI-NEMA committee, as new concepts and additional data on system grounding practices, maximum operating voltages and equipment with reduced insulation levels, are developed.



Because of many different factors affecting the choice of basic insulation level (BIL) in the insulation of a modern power system, the relationship between system operating voltage and BIL may vary. For example, a 230 KV switch may have a BIL of 900 KV or 1050 KV. It is recommended that the selection of insulator units and stacks in modern station design be based on the basic insulation level rather than on the system operating voltage.

As a guide for selection, the tabulation shows the relationship between BIL and system voltage which has been typical of past engineering practice.

BIL*	Nominal System Voltage
30	1.2
45	2.5
60	4.8
75	7.2
95	7.2, 8.3, 13.2
110	14.4
150	23
200	34.5
250	46
350	69
450	92, 115
550	115, 138
650	138, 161
750	161
825	230
900	230
1050	230, 287
1300	287, 345
1425	460

*Expressed in KV crest value of withstand voltage of a 1.5 x 40 microsecond full impulse wave.

INSULATORS
CAP AND PIN TYPE

DESIGN FEATURES

The reliability and proven performance of cap and pin switch insulators is attested by the great numbers of these units in service—far exceeding other types. Standardization of units having a wide range of use has greatly simplified the problem of selection for any particular application. Standard strength insulators are available for each circuit voltage class from 7.5 KV to 345 KV. In addition, high strength units having greater mechanical strength are available for specialized needs. Above 69 KV, only one insulator unit is required to build stacks for all voltages accomplishing maximum interchangeability and minimum stocks. Combinations of insulators in high voltage stacks can also be employed, providing necessary cantilever strength at maximum economy.

Most cap and pin insulators are formed of two or more shells nested together to achieve optimum electrical characteristics. In this type construction, each individual shell can be thoroughly inspected and tested prior to assembly. Also greater uniformity and homogeneity of the porcelain shells can be obtained in all manufacturing operations, enhancing the physical properties of the insulators.

Breaking the shell of a multi-shell insulator in service will not normally result in an outage. The remaining portion will continue to support apparatus and insulate system voltage until the insulator can be replaced.

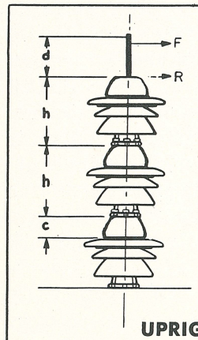
The high dielectric strength of a multi-shell insulator is achieved by reliable porcelain barriers, each having been thoroughly tested prior to assembly. It will generally perform better in contaminated areas where surface dirt reduces the flashover of an insulator. The large shells of different diameters of the cap and pin insulator provide more protected leakage distance and larger drip paths preventing bridging across the air gaps by drip streams. The wider spacing permits easy cleaning by wind and rain and shells are less likely to trap dirt or other contaminants than closely spaced hoods. Rain shields are not required to break up drip streams over the surface of the insulator and small angles of vertical misalignment have little effect upon the wet flashover performance.

Ideally, the positive and negative impulse flashover of an insulator should be identical, particularly for switch applications. Cap and pin switch insulators approach this characteristic better than other types of switch units, providing maximum safety in a switch of minimum dimensions. Lower unit weights of the switch insulator permit greater ease in assembly and installation. For high impact loads, the flexibility of the cap and pin insulator provides for increased shock absorption with less risk of damage.

SWITCH AND BUS CAP AND

CANTILEVER STRENGTH

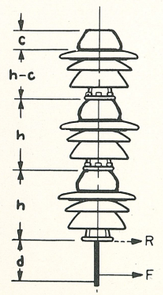
Cantilever strength is often critical in insulator application. All cantilever ratings shown in the tables assume that the load is applied flush with cap or pin. If cantilever loads are applied at any other point, the allowable load at that point will vary inversely as the effective moment arm. The normal fracture location under cantilever loading is near the lip of the cap of the unit at the supported end of the stack. Fig. 1 illustrates a method for calculating cantilever strength in such cases. These formulae should be used *only* for stacks of two or more units. For special applications or single units of stacking insulators, refer to factory for recommendations.



R=RATED UPRIGHT CANTILEVER STRENGTH
F=CANTILEVER STRENGTH FOR LOADS APPLIED AT DISTANCE "d" ABOVE TOP OF CAP
h=UNIT HEIGHT
c=CAP HEIGHT
n=NUMBER OF UNITS IN STACK

$$F = R\left[\frac{(n-1)h+c}{(n-1)h+c+d}\right]$$

UPRIGHT MOUNTING



R=RATED CANTILEVER STRENGTH
F=CANTILEVER STRENGTH FOR LOADS APPLIED AT DISTANCE "d" BELOW BASE OF INSULATOR
h=UNIT HEIGHT
c=CAP HEIGHT
n=NUMBER OF UNITS IN STACK

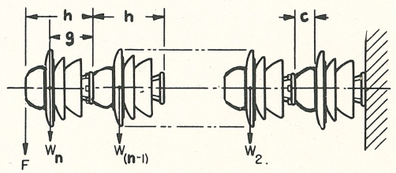
$$F = R\left[\frac{nh-c}{nh-c+d}\right]$$

UNDERHUNG MOUNTING

Figure 1

HORIZONTAL MOUNTING

In horizontal mounting of multiple unit stacks, the bending moment imposed on the base unit by the weight of the other units may form a large portion of the allowable rated moment. Fig. 2 shows a method of calculating external load which can be carried by a stack of units in horizontal position.



R—RATED CANTILEVER STRENGTH
F—RESIDUAL CANTILEVER STRENGTH AVAILABLE FOR SUPPORT OF EXTERNAL LOAD
n—NUMBER OF UNITS IN STACK
h—HEIGHT OF UNIT
c—HEIGHT OF CAP
g—DISTANCE OF CENTER OF GRAVITY OF EACH UNIT ABOVE ITS BASE (60% of h)
$W_1, W_2, W_3 \ldots W_n$ = WEIGHTS OF INDIVIDUAL UNITS COUNTING FROM GROUND END

$$F = \frac{R[(n-1)h+c] - W_2(g+c) - W_3(g+c+h) \cdots W_n[g+c+(n-2)h]}{(n-1)h+c}$$

IF ALL UNITS HAVE THE SAME WEIGHT THEN

$$W_2 = W_3 = \ldots\ldots W_n = W$$

AND

$$F = \frac{R[(n-1)h+c] - W(n-1)\left[\frac{(n-2)h}{2}+g+c\right]}{(n-1)h+c}$$

Figure 2

INSULATORS PIN TYPE

CANTILEVER STRENGTHS ABOVE CAP AND BELOW BASE

LOCKE CATALOG NUMBER	T. R. No.	Cantilever Strength, Pounds									
		Rating		Inches Above Cap				Inches Below Base			
		Upright	Underhung	1	2	3	4	1	2	3	4
29153	13	2000	1000	1700	1500	1350	1250	900	825	800	780
29200	1	2000	1000	1710	1525	1400	1300	800	700	600	570
29250	4	2000	1000	1600	1300	1150	1000	800	700	575	500
29251	7	2000	1000	1600	1300	1100	900	800	700	620	575
29455	10	2000	1000	1600	1325	1150	1050	850	750	675	600
30153	53	4000	2500	3400	3000	2650	2400	2350	2150	2050	1950
30200	41	4000	3000	2900	2300	1900	1700	2500	2150	1900	1700
30250	44	4000	3000	3100	2500	2150	1850	2600	2300	2050	1850
30251	46	4000	3000	3250	2720	2400	2160	2700	2450	2250	2100
30455	49	4000	3000	3250	2750	2440	2240	2700	2500	2300	2200

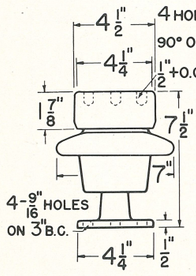
VOLTAGE RATING INDEX

ASA Standard Units shown in bold type.

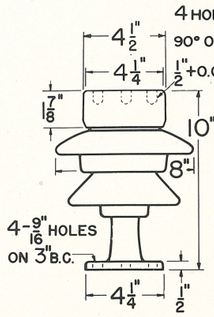
VOLTAGE RATING KV		STANDARD STRENGTH			HIGH STRENGTH			EXTRA HIGH STRENGTH		
Standard	Non-Standard	LOCKE Catalog Number	T.R. No.	Page No.	LOCKE Catalog Number	T.R. No.	Page No.	LOCKE Catalog Number	T.R. No.	Page No.
7.5	7.5S	**29200**	**1**	**8**	**30200**	**41**	**10**	32200	58	12
15		**29250**	**4**	**8**	**30250**	**44**	**10**			
23		**29251**	**7**	**8**	**30251**	**46**	**10**			
34.5	34.5S	**29455**	**10**	**8**	**30455** 2-32200	**49** 86	**10** 12			
46	46S	**29153** 3-32200	**13** 100	**8** 12	**30153**	**53**	**10**			
69		**2-29511**	**16**	**8**	**2-7785**	**56**	**10**	2-23333	—	14
	88S 110S	3-8888 4-8888	117 121	12 12						

SWITCH AND BUS CAP AND PIN TYPE INSULATORS

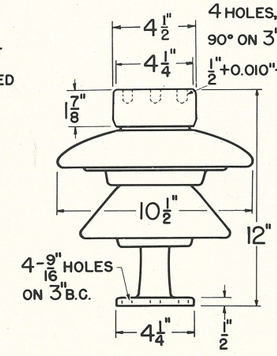
STANDARD STRENGTH
BIL UNITS—ASA STD.
7.5 – 69 KV.



NO. 29200
7.5 KV



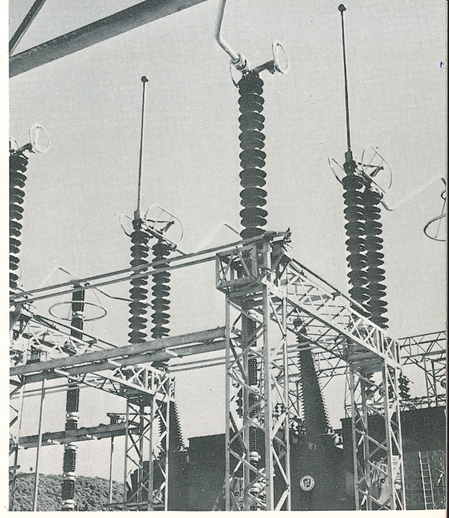
NO. 29250
15 KV



NO. 29251
23 KV

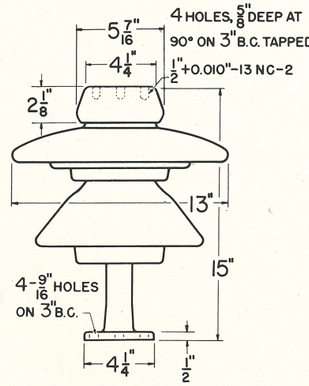
Voltage Rating KV	LOCKE Catalog Number	ASA T. R. No.	Flashover—KV				Withstand Voltage—KV			Radio Influence Voltage	
			Low Frequency		Impulse		Low Frequency		Impulse	Test KV to Ground	Max. MV at 1000 Kc
			Dry	Wet	Pos.	Neg.	Dry 1 Min.	Wet 10 Sec.			
7.5	29200	1	60	40	105	120	36	30	95	5	50
15	29250	4	85	55	125	200	50	45	110	10	50
23	29251	7	110	75	170	250	70	60	150	15	100
34.5	29455	10	145	100	225	290	95	80	200	22	100
46	29153	13	170	125	280	340	120	100	250	30	200
69	2 of 29511	Stack 16 / Unit 147	235	180	390	475	175	145	350	44	200

Depth shown for all tapped holes is full thread depth.

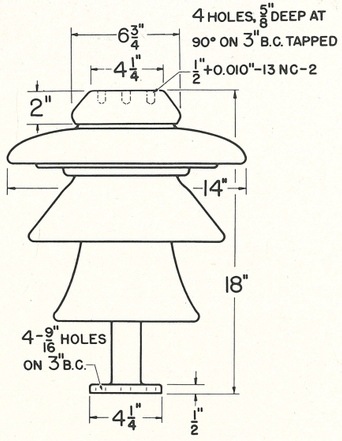


Locke 31444 insulators on Pennsylvania Electric Company's 460KV Saxton substation.

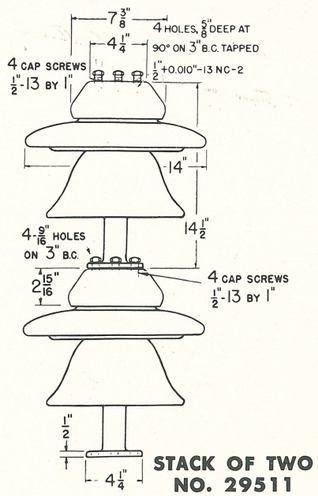
Cap screws are not furnished as standard equipment, except on #29511. Cantilever strengths above cap and below base are shown on page 7.



NO. 29455
34.5 KV

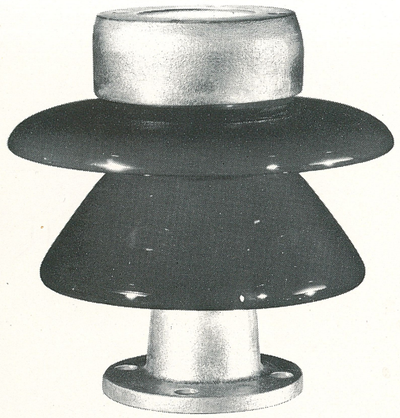


NO. 29153
46 KV



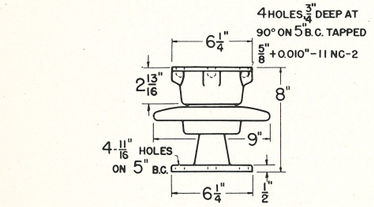
STACK OF TWO NO. 29511
69 KV

Mechanical Strength					Leakage Distance Inches	Dry Arcing Distance Inches	Weight Each—Lbs.		Std. Pkg. Quan.	LOCKE Catalog Number	Voltage Rating KV
Cantilever—Lbs.		Torsion In—Lbs.	Tension Lbs.	Comp. Lbs.			Net	Pkd.			
Upright	Underhung										
2000	1000	6000	5000	10000	7 1/2	5 1/4	11	12	6	29200	7.5
2000	1000	7000	5000	10000	12	7 1/4	16	18	4	29250	15
2000	1000	8000	5000	10000	20	9 1/2	25	30	3	29251	23
2000	1000	10000	7000	15000	28	13 1/2	38	45	2	29455	34.5
2000	1000	12000	8000	15000	36	17	54	68	1	29153	46
1500	1000	15000	12000	25000	52	28	46	53	2	2 of 29511	69



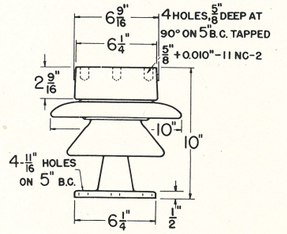
SWITCH AND BUS CAP AND PIN TYPE INSULATORS

HIGH STRENGTH
BIL UNITS—ASA STD.
7.5 – 69 KV.



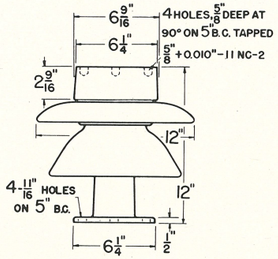
NO. 30200

7.5 KV



NO. 30250

15 KV

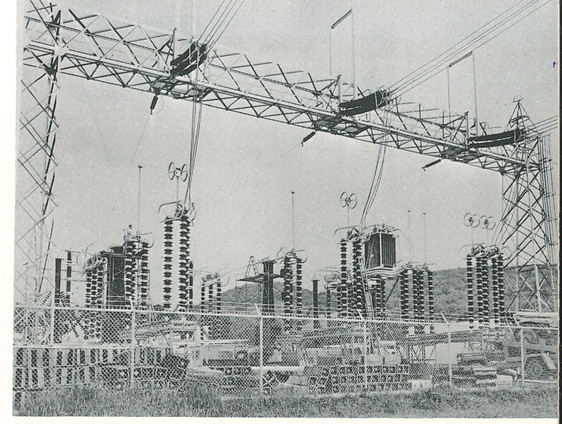


NO. 30251

23 KV

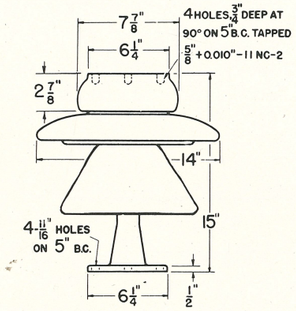
Voltage Rating KV	LOCKE Catalog Number	ASA T. R. No.	Flashover—KV				Withstand Voltage—KV			Radio Influence Voltage	
			Low Frequency		Impulse		Low Frequency		Impulse	Test KV to Ground	Max. MV at 1000 Kc
			Dry	Wet	Pos.	Neg.	Dry 1 Min.	Wet 10 Sec.			
7.5	**30200**	41	60	40	105	120	36	30	95	5	50
15	**30250**	44	85	55	125	200	50	45	110	10	50
23	**30251**	46	110	75	170	250	70	60	150	15	100
34.5	**30455**	49	145	100	225	290	95	80	200	22	100
46	**30153**	53**	170	125	280	340	120	100	250	30	200
69	**2 of 7785**	56	280*	190*	410*	540*	205*	160*	350*	44	200

Depth shown for all tapped holes is full thread depth.
*These values obtained with insulators mounted on 3½" subbase, which must be ordered separately.
**No. 30153 is Non-ASA Standard, NEMA approved.



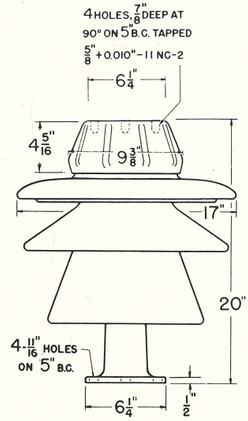
North substation at General Electric Project EHV, Pittsfield, shows a forest of Locke 31444 extra high strength insulators.

Cap screws are not furnished as standard equipment, except on #7785. Cantilever strengths above cap and below base are shown on page 7.



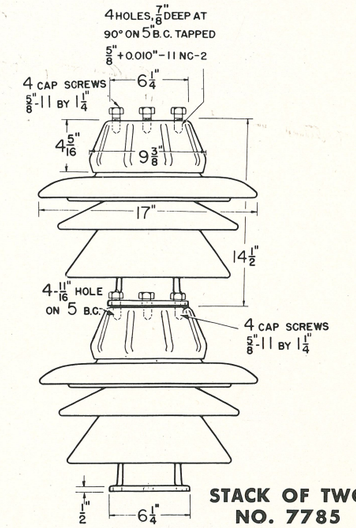
NO. 30455

34.5 KV



NO. 30153

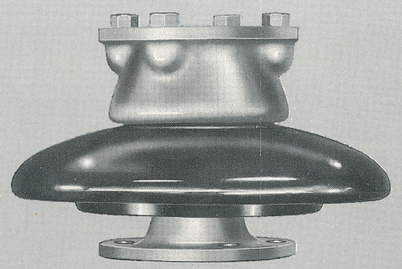
46 KV



STACK OF TWO NO. 7785

69 KV

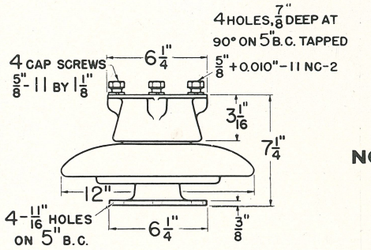
Mechanical Strength					Leakage Distance Inches	Dry Arcing Distance Inches	Weight Each—Lbs.		Std. Pkg. Quan.	LOCKE Catalog Number	Voltage Rating KV
Cantilever—Lbs.		Torsion In—Lbs.	Tension Lbs.	Comp. Lbs.			Net	Pkd.			
Upright	Underhung										
4000	3000	12000	10000	20000	8	5¼	23	30	4	**30200**	7.5
4000	3000	14000	10000	20000	14	7¼	31	38	4	**30250**	15
4000	3000	16000	10000	20000	18	9½	36	44	2	**30251**	23
4000	3000	20000	14000	30000	28	13½	55	70	2	**30455**	34.5
4000	2500	20000	15000	30000	40	18	88	118	1	**30153**	46
3000	2350	40000	20000	60000	66	29	80	91	1	**2 of 7785**	69



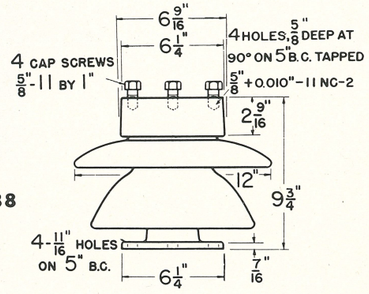
SWITCH AND BUS CAP AND

UNITS FOR SPECIAL APPLICATIONS

NO. 32200



NO. 8888



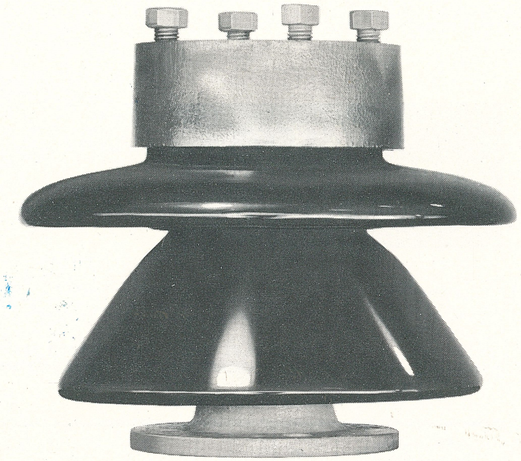
Impulse Withstand Voltage KV	LOCKE Catalog Number	No. of Units	NEMA T. R. No.	Leakage Distance Inches	Dry Arcing Distance Inches	Mechanical Strength			Weight—Lbs.		Std. Pkg. Quan.
						Torsion In—Lbs.	Tension Lbs.	Comp. Lbs.	Net	Pkd.	
95	32200	1	58	13.5	7½	20000	12000	25000	27	31	4
190		2	86	27	14¾	—	—	—	54	—	—
250		3	100	40.5	22	—	—	—	81	—	—
—		4	—	54	29¼	—	—	—	108	—	—
—		5	—	67.5	36½	—	—	—	135	—	—
140	8888	1	145	18	9½	16000	10000	20000	33	40	3
—		2	—	36	19¼	—	—	—	66	—	—
375		3	117	54	29	—	—	—	99	—	—
450		4	121	72	38¾	—	—	—	132	—	—
—		5	—	90	48½	—	—	—	155	—	—

Depth shown on all tapped holes is full thread depth.

INSULATORS

PIN TYPE

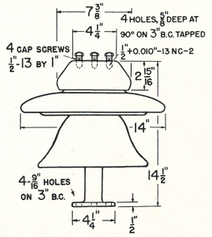
Cap screws are furnished as standard equipment.



Flashover—KV				Withstand Voltage —KV		Cantilever Strength Lbs.		Radio Influence Voltage		LOCKE Catalog Number	Impulse With-stand Voltage KV
Low Frequency		Impulse		Low Frequency		Upright	Under-hung	Test KV to Ground	Max. MV at 1000 Kc		
Dry	Wet	Pos.	Neg.	Dry 1 Min.	Wet 10 Sec.						
75	45	125	135	35	30	6000	4000	5	50	32200	95
135	85	230	275	70	60	3000	2400	22	100		190
195	125	320	375	120	100	1800	1600	30	200		250
255	160	410	490	—	—	1250	1100	—	—		—
310	200	500	600	—	—	1000	900	—	—		—
100	60	155	200	70	45	4000	3000	15	100	8888	140
195	120	305	390	165	100	1750	1300	42	200		250
280	180	425	550	240	145	975	800	56	200		375
350	235	525	675	280	190	675	600	70	200		450
415	290	625	800	—	—	520	475	—	—		—

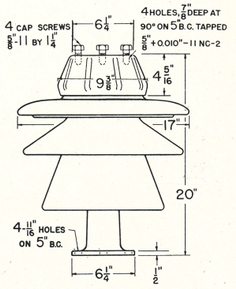
SWITCH AND BUS CAP AND

STACK COMBINATIONS 350 — 750 BIL



NO. 29511 (T.R. 147)
STANDARD STRENGTH

NO. 30153 (T.R. 53)
HIGH STRENGTH



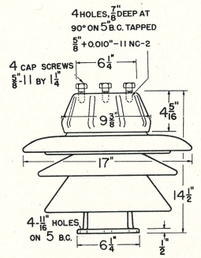
STACK

BIL Impulse Withstand Voltage KV	No. of Units in Stack	LOCKE Catalog Number	Suggested KV Rating	Stack T.R. No.	Standard Approval	Height Inches	Flashover—KV				Low Frequency Withstand KV		Radio Influ. Voltage		Leakage Dist. In.	Dry Arc. Dist. In.
							Low Frequ.		Impulse							
							Dry	Wet	Pos.	Neg.	Dry 1 Min.	Wet 10 Sec.	Test KV to Ground	Max. MV at 1000 Kc		
350	2	2-29511	69	16	ASA	29	235	180	390	475	175	145	44	200	66	29
		2-7785		56	ASA		280	190	410	540	205	160				
		1-7785 1-23333		—	—		280	190	410	540	205	160				
		2-23082		—	—		280	190	410	540	205	160				
		2-23333		—	—		280	190	410	540	205	160				
550	3	3-7785	115	19	ASA	43½	385	285	610	780	280	230	73	200	99	44
500*		2-7785 1-23082		—	—		360	275	550	710	275	225				
550		2-7785 1-23333		183	NEMA		385	285	610	780	280	230				
550		3-23082		122	NEMA		385	285	610	780	280	230				
550		3-23333		173	NEMA		385	285	610	780	280	230				
650	3	1-30153 2-7785	138	22	NEMA	49	435	335	680	800	335	275	73	200	102	46
620*		1-30153 1-7785 1-23082		—	—		425	325	650	800	325	265				
650		1-30153 1-7785 1-23333		180	NEMA		435	335	680	800	335	275				
750	4	4-7785	138/161	25	ASA	58	485	380	810	1020	385	315	103	500	132	58
725*		3-7785 1-23082		26	NEMA		475	370	780	980	375	305				
750		3-7785 1-23333		184	NEMA		485	380	810	1020	385	315				
710*		2-7785 2-23082		—	—		450	360	770	920	360	300				
750		2-7785 2-23333		—	—		485	380	810	1020	385	315				
750		4-23082		123	ASA		485	380	810	1020	385	315				
750		4-23333		174	NEMA		485	380	810	1020	385	315				
750		1-23083 3-31444		—	—		485	380	810	1020	385	315				
750		4-31444		—	—		485	380	810	1020	385	315				

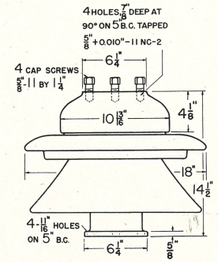
* Non-standard BIL

INSULATORS

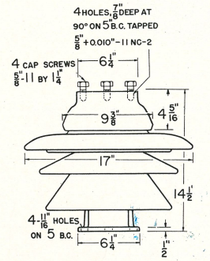
PIN TYPE



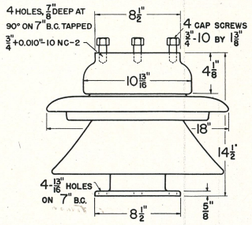
NO. 7785 (T.R. 140)
STANDARD STRENGTH



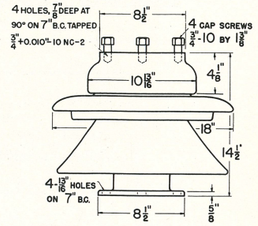
NO. 23082 (T.R. 141)
HIGH STRENGTH



NO. 23333 (T.R. 139)
HIGH STRENGTH



NO. 23083 (T.R. 142)
HIGH STRENGTH



NO. 31444
EXTRA HIGH STRENGTH

CHARACTERISTICS

Deflection Inches Per 100 Lbs.	Mechanical Strength					LOCKE Catalog Number	No. of Units in Stack	BIL Impulse Withstand Voltage KV
	Cantilever—Lbs.		Torsion in 1000 In—Lbs.	Tension in 1000 Lbs.	Comp. in 1000 Lbs.			
	Upright	Underhung						
.100	1500	1000	15	12	25	2-29511	2	350
.010	3000	2350	40	20	60	2-7785		
.010	4500	3500	40	20	60	1-7785 1-23333		
.006	4500	3500	90	25	60	2-23082		
.010	4500	3500	90	25	60	2-23333		
.034	1700	1470	40	20	60	3-7785	3	550
.025	2900	2350	40	20	60	2-7785 1-23082		500*
.034	2900	2350	40	20	60	2-7785 1-23333		550
.018	2900	2400	90	25	60	3-23082		550
.034	2900	2400	90	25	60	3-23333		550
.050	1450	1250	20	15	30	1-30153 2-7785	3	650
.040	2350	1900	20	15	30	1-30153 1-7785 1-23082		620*
.050	2350	1900	20	15	30	1-30153 1-7785 1-23333		650
.090	1200	1070	40	20	60	4-7785	4	750
.055	1700	1470	40	20	60	3-7785 1-23082		725*
.080	1700	1470	40	20	60	3-7785 1-23333		750
.060	2000	1750	40	20	60	2-7785 2-23082		710*
.075	2000	1750	40	20	60	2-7785 2-23333		750
.040	2000	1750	90	25	75	4-23082		750
.075	2000	1750	90	25	75	4-23333		750
.025	2900	2400	90	25	75	1-23083 3-31444		750
.025	3500	3500	120	40	100	4-31444		750

UNIT CHARACTERISTICS

LOCKE Catalog Number	Unit T.R. No.	Lkg. Dist. In.	Dry Arc. Dist. In.	Lbs. Each		Std. Pkg. Quan.
				Net	Pkd.	
29511	147	26	13¾	46	53	2
30153	53	40	18	88	118	1
7785	140	33	14¾	80	91	1
23082	141	33	14¾	114	126	1
23333	139	33	14¾	87	100	1
23083	142	33	14¾	117	131	1
31444	—	33	14¾	125	143	1

NOTES:

Electrical characteristics of combination stacks involving T. R. 140 units and T. R. 141 units must be reduced below the established ASA Standards for stacks of the same height. This is necessary because of the capacitance unbalance that exists between the T. R. 140 and T. R. 141 insulators. Where the 23333 (T. R. 139) insulator is used instead of the T. R. 141, this unbalance does not exist and the electrical characteristics are equal to ratings of non-mixed stacks.

Flashover and withstand voltage values are predicated on the use of a 3½" high subbase except stack using 29511.

High strength insulator No. 23333 and extra high strength insulator No. 31444 are furnished with gray glaze for immediate identification. Brown glaze will be supplied on request.

SWITCH AND BUS CAP AND INSULATORS

STACK COMBINATIONS (CONT.)
900 – 1300 BIL

STACK

BIL Impulse Withstand Voltage KV	No. of Units in Stack	LOCKE Catalog Number	Suggested KV Rating	Stack T.R. No.	Standard Approval	Height Inches	Flashover—KV				Low Frequency Withstand KV	
							Low Frequ.		Impulse			
							Dry	Wet	Pos.	Neg.	Dry 1 Min.	Wet 10 Sec.
900	5	5-7785	196	126	ASA	72½	575	475	1010	1240	465	385
		4-7785 1-23333		—	—		575	475	1010	1240	465	385
		3-7785 2-23082		160	NEMA		525	425	970	1100	440	365
		3-7785 2-23333		185	NEMA		575	475	1010	1240	465	385
		5-23082		27	ASA		575	475	1010	1240	465	385
		5-23333		175	NEMA		575	475	1010	1240	465	385
		4-23083 1-31444		—	—		575	475	1010	1240	465	385
		3-23083 2-31444		—	—		575	475	1010	1240	465	385
		5-31444		—	—		575	475	1010	1240	465	385
1050	6	6-7785	230	128	ASA	87	660	570	1210	1450	545	455
		5-7785 1-23333		—	—		660	570	1210	1450	545	455
		4-7785 2-23082		161	NEMA		610	520	1170	1310	510	435
		4-7785 2-23333		186	NEMA		660	570	1210	1450	545	455
		6-23082		28	ASA		660	570	1210	1450	545	455
		6-23333		176	NEMA		660	570	1210	1450	545	455
		5-23083 1-31444		—	—		660	570	1210	1450	545	455
		4-23083 2-31444		—	—		660	570	1210	1450	545	455
		6-23083		129	ASA		660	570	1210	1450	545	455
		6-31444		—	—		660	570	1210	1450	545	455
1300	7	7-7785	287	—	—	101½	745	660	1410	1650	610	525
1300		6-7785 1-23333		—	—		745	660	1410	1650	610	525
1300		5-7785 2-23333		—	—		745	660	1410	1650	610	525
1225*		4-7785 3-23082		162	NEMA		715	575	1330	1450	590	480
1300		4-7785 3-23333		187	NEMA		745	660	1410	1650	610	525
1300		7-23082		131	NEMA		745	660	1410	1650	610	525
1300		7-23333		177	NEMA		745	660	1410	1650	610	525
1300		5-23083 2-31444		—	—		745	660	1410	1650	610	525
1300		4-23083 3-31444		—	—		745	660	1410	1650	610	525
1300		7-23083		133	ASA		745	660	1410	1650	610	525
1300		7-31444		—	—		745	660	1410	1650	610	525

* Non-standard BIL

See notes and unit characteristics pages 14 and 15.

PIN TYPE

CHARACTERISTICS

Radio Infl. Voltage		Leakage Dist. In.	Dry Arc. Dist. In.	Deflection Inches Per 100 Lbs.	Mechanical Strength					LOCKE Catalog Number	No. of Units in Stack	BIL Impulse Withstand Voltage KV
					Cantilever—Lbs.		Torsion in 1000 In—Lbs.	Tension in 1000 Lbs.	Comp. in 1000 Lbs.			
Test KV to Ground	Max. MV at 1000 Kc				Up-right	Under-hung						
125	500	165	73	.175	910	840	40	20	60	5-7785	5	900
				.160	1200	1070	40	20	60	4-7785 1-23333		
				.110	1450	1350	40	20	60	3-7785 2-23082		
				.145	1450	1350	40	20	60	3-7785 2-23333		
				.080	1450	1350	90	25	75	5-23082		
				.140	1450	1350	90	25	75	5-23333		
				.050	2000	1750	90	25	75	4-23083 1-31444		
				.050	2000	1750	90	25	75	3-23083 2-31444		
				.050	2750	2750	120	40	100	5-31444		
146	500	198	87	.320	750	700	40	20	60	6-7785	6	1050
				.280	910	840	40	20	60	5-7785 1-23333		
				.185	1170	1100	40	20	60	4-7785 2-23082		
				.255	1170	1100	40	20	60	4-7785 2-23333		
				.140	1170	1100	90	25	75	6-23082		
				.240	1170	1100	90	25	75	6-23333		
				.090	1450	1350	90	25	75	5-23083 1-31444		
				.090	2000	1750	90	25	75	4-23083 2-31444		
				.090	1170	1100	90	25	75	6-23083		
				.090	2300	2300	120	40	100	6-31444		
180	1000	231	102	.500	620	580	40	20	60	7-7785	7	1300
				.460	745	660	40	20	60	6-7785 1-23333		1300
				.410	910	840	40	20	60	5-7785 2-23333		1300
				.270	1000	950	40	20	60	4-7785 3-23082		1225*
				.380	1000	950	40	20	60	4-7785 3-23333		1300
				.230	1000	950	90	25	75	7-23082		1300
				.380	1000	950	90	25	75	7-23333		1300
				.145	2000	2000	90	25	75	5-23083 2-31444		1300
				.145	2000	1750	90	25	75	4-23083 3-31444		1300
				.145	1000	950	90	25	75	7-23083		1300
				.145	2000	2000	120	40	100	7-31444		1300

SWITCH AND BUS CAP AND INSULATORS PIN TYPE

STACK COMBINATIONS (CONT.) 1470 — 1800 BIL

STACK

BIL Impulse Withstand Voltage KV	No. of Units in Stack	LOCKE Catalog Number	Stack T.R. No.	Standard Approval	Height Inches	Flashover—KV				Low Frequency Withstand KV	
						Low Frequ.		Impulse			
						Dry	Wet	Pos.	Neg.	Dry 1 Min.	Wet 10 Sec.
1470	8	8-7785	—	—	116	830	740	1610	1850	680	590
		7-7785 1-23333	—	—		830	740	1610	1850	680	590
		6-7785 2-23333	—	—		830	740	1610	1850	680	590
		5-7785 3-23082	163	NEMA		775	625	1450	1650	650	525
		5-7785 3-23333	188	NEMA		830	740	1610	1850	680	590
		8-23082	136	NEMA		830	740	1610	1850	680	590
		8-23333	178	NEMA		830	740	1610	1850	680	590
		6-23083 2-31444	—	—		830	740	1610	1850	680	590
		5-23083 3-31444	—	—		830	740	1610	1850	680	590
		8-23083	135	ASA		830	740	1610	1850	680	590
		8-31444	—	—		830	740	1610	1850	680	590
1640*	9	7-23083 2-31444	—	—	130½	910	820	1810	2050	745	650
		6-23083 3-31444	—	—		910	820	1810	2050	745	650
		5-23083 4-31444	—	—		910	820	1810	2050	745	650
		9-23083	153	NEMA		910	820	1810	2050	745	650
		9-31444	—	—		910	820	1810	2050	745	650
1800	10	7-23083 3-31444	—	—	145	990	900	2000	2240	810	710
		6-23083 4-31444	—	—		990	900	2000	2240	810	710
		5-23083 5-31444	—	—		990	900	2000	2240	810	710
		10-23083	157	NEMA		990	900	2000	2240	810	710
		10-31444	—	—		990	900	2000	2240	810	710

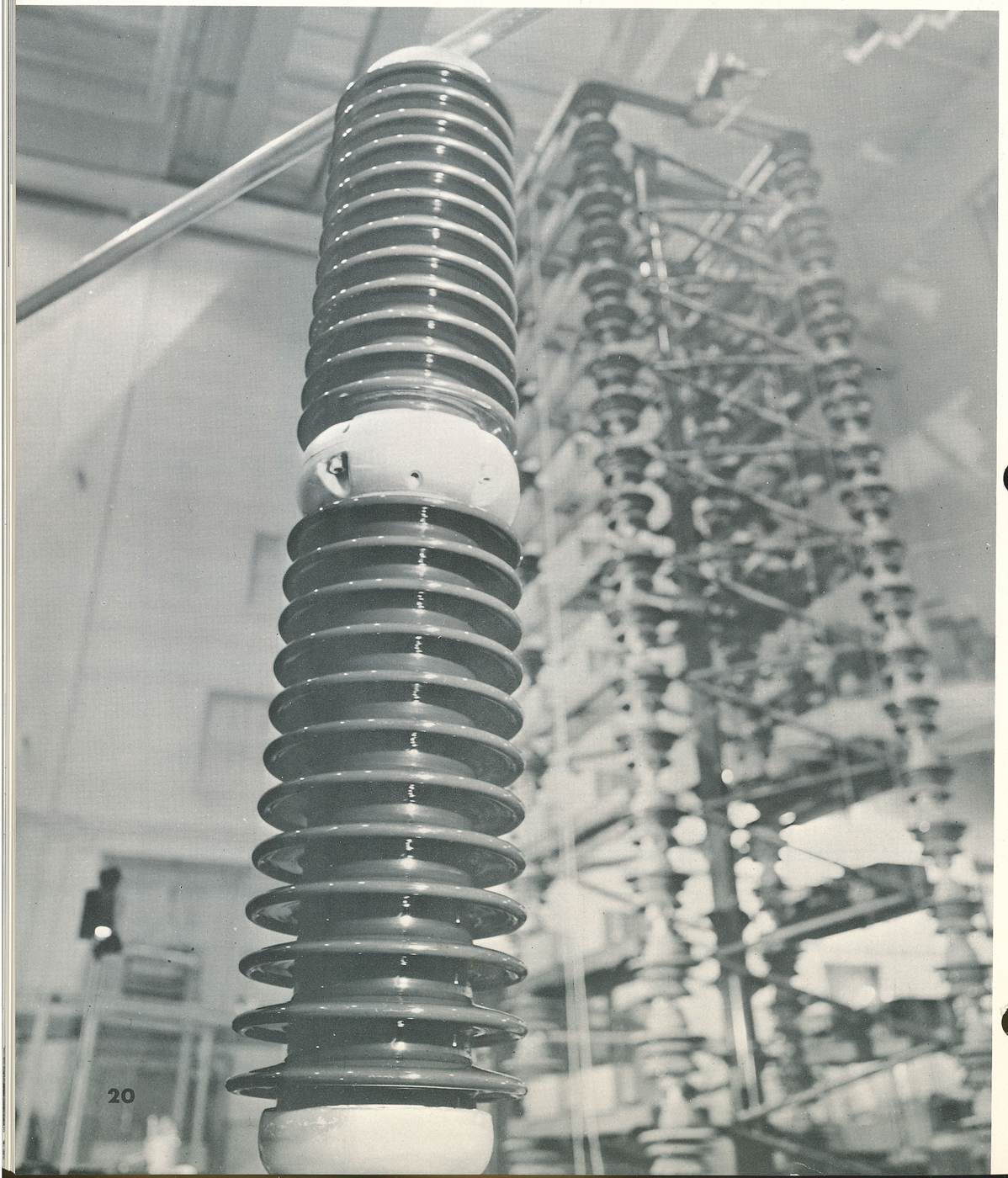
*Non-standard BIL

See notes and unit characteristics pages 14 and 15.

CHARACTERISTICS

Radio Infl. Voltage		Leakage Dist. In.	Dry Arc. Dist. In.	Deflection Inches Per 100 Lbs.	Mechanical Strength					LOCKE Catalog Number	No. of Units in Stack	BIL Impulse Withstand Voltage KV
					Cantilever—Lbs.		Torsion in 1000 In—Lbs.	Tension in 1000 Lbs.	Comp. in 1000 Lbs.			
Test KV to Ground	Max. MV at 1000 Kc				Up-right	Under-hung						
1000	264	116	—	525	480	40	20	60	8-7785	8	1470	
			.710	620	580	40	20	60	7-7785 1-23333			
			.640	750	700	40	20	60	6-7785 2-23333			
			.430	900	840	40	20	60	5-7785 3-23082			
			.600	900	840	40	20	60	5-7785 3-23333			
			.330	900	860	90	25	75	8-23082			
			.540	900	860	90	25	75	8-23333			
			.210	1170	1100	90	25	75	6-23083 2-31444			
			.210	1450	1350	90	25	75	5-23083 3-31444			
			.210	900	860	90	25	75	8-23083			
			.210	1750	1750	120	40	100	8-31444			
2000	297	131	.290	1000	950	90	25	75	7-23083 2-31444	9	1640*	
			.290	1170	1100	90	25	75	6-23083 3-31444			
			.290	1450	1350	90	25	75	5-23083 4-31444			
			.290	770	740	90	25	75	9-23083			
			.290	1550	1550	120	40	100	9-31444			
2000	330	145	.390	1000	950	90	25	75	7-23083 3-31444	10	1800	
			.390	1170	1100	90	25	75	6-23083 4-31444			
			.390	1400	1350	90	25	75	5-23083 5-31444			
			.390	680	660	90	25	75	10-23083			
			.390	1400	1400	120	40	100	10-31444			

SWITCH AND BUS
STATION POST TYPE



INSULATORS
GENERAL INFORMATION

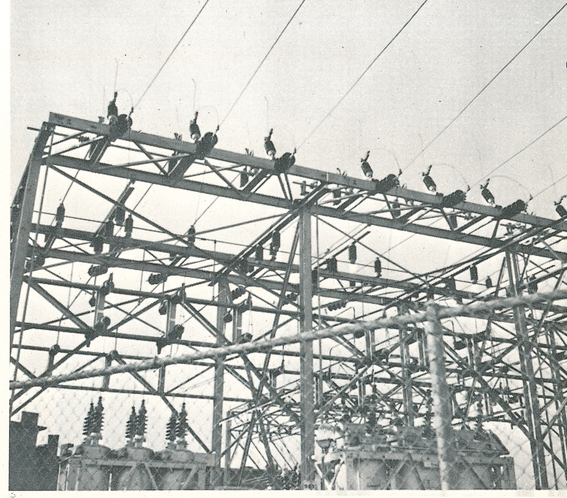
DESIGN FEATURES

The post is essentially a columnar type insulator consisting of a hollow, closed end porcelain having a multiplicity of hoods or petticoats. The air column is provided due to the difficulty of drying and firing thick solid porcelain sections with uniformity. This design requires special precautions to properly seal off the cavity to prevent any moisture from entering and affecting the electrical characteristics of the insulator. In a Locke post insulator, a special metal-polymer seal of proven superiority prevents any possibility of moisture penetration. An additional precaution is also taken by inserting a desiccant in the cavity to absorb any residual moisture.

The post insulator provides more leakage distance in a smaller diameter than any other type insulator. The compactness and small hood diameter of the post not only enhances the appearance of the modern station, but may also be desirable where tight space requirements exist. Wide spaced, wash-type petticoats provide maximum protection of under surfaces against dirt accumulation and yet permit maximum natural washing. Wider spacing of the hoods provides more effective leakage distance and retards the bridging action of drip streams. The ruggidized mechanical design insures trouble free performance and freedom from damage from power arcs or stones and bullets.

Mounting hardware is cemented to the porcelain column externally, eliminating the possibility of internal bursting stresses arising from thermal expansion of hardware. With fewer bolt and cement joints, along with the inherent stiffness of the post insulator, deflection will be minimized, providing fewer alignment problems. Because of the symmetrical construction of post insulators, mechanical strength is not affected by the mounting position.

In the post type insulator, a long column of porcelain is assembled between the high voltage and grounded electrode. Because of this construction, post insulators have very low capacitance and excellent RIV characteristics. Also the electrical stress in the porcelain will be much lower as long as the integrity of the seal is maintained.



A substation in northern New England using Locke station posts built about 1939.

Insulator taken out of service after six years for lab tests. Removal of cap and cement revealed no deterioration of metal disc. Even under 10 p.s.i. pressure, "sniff" tests were negative, proving seal completely effective.

SWITCH AND BUS STATION INSULATORS
POST TYPE

STACKING POST INSULATORS

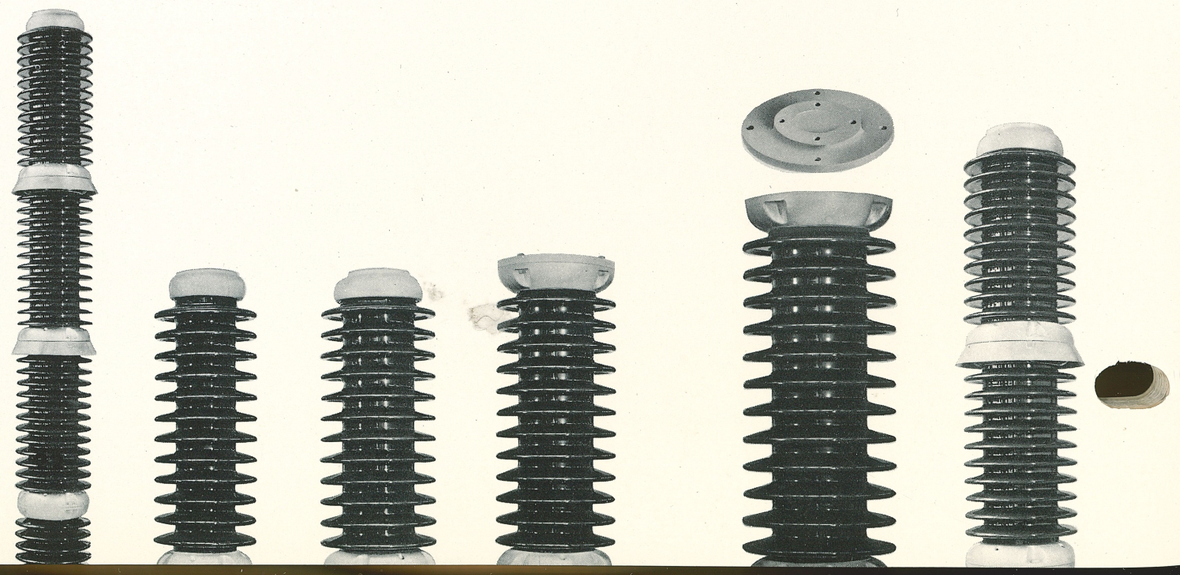
Combining proven designs with sound engineering practice and the accumulated experience of many years, the largest selection of stacking post insulators is now available for BIL ratings from 550 KV to 1470 KV. For complete design flexibility, insulators are available in three different strength classes with two different stacking arrangements and conform to the applicable current NEMA specifications.

TYPE A STACKING POSTS

These post insulators consist of two or more unit assemblies bolted together to form a stack. The height of the insulator stack and number of units in it is dependent upon the electrical requirements. Separate porcelains within the stack are customized to function in a particular location, either as a top unit, intermediate unit, or bottom unit and cannot be interchanged. Flange type hardware and thru bolts permit easy assembly of the component units in the stack. Malleable iron caps used for mounting on standard bolt circles of station equipment provide interchangeability with conventional cap and pin switch insulators. This particular type of construction avoids the use of adapter plates which eliminates any clearance problems in mounting, reduces deflection by using fewer bolts and reduces installation time.

TYPE B STACKING POSTS

The Type B post stacks provide for maximum interchangeability of the sub-assemblies within the stack. In any particular stack the same unit is used, whether it be at the top or middle, or bottom. To obtain the interchangeable feature, flange type hardware is used on all of the sub-assemblies. For mounting purposes, adapter plates are provided for attachment to standard bolt circle mountings of bus supports, switches, or station steelwork. Outside diameters of the mounting hardware fittings will be slightly larger than that of cap and pin or Type A posts.



CANTILEVER STRENGTHS ABOVE AND BELOW CAPS

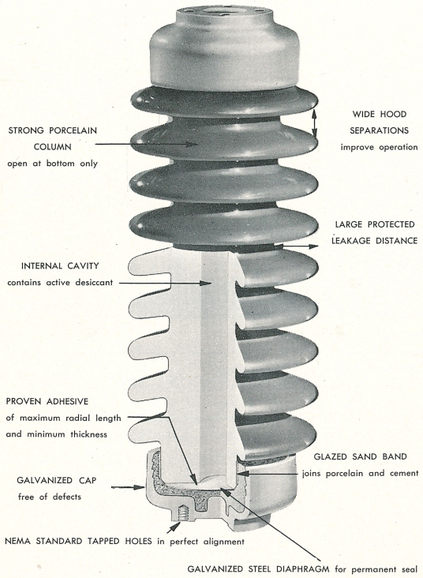
LOCKE CATALOG NUMBER	T. R. No.	Cantilever Strengths, Pounds				
		Rating	Inches Above and Below Cap			
			1	2	3	4
29007	202	2000	1700	1470	1300	1150
29015	205	2000	1780	1600	1450	1330
29023	208	2000	1850	1700	1600	1500
29034	210	2000	1880	1770	1680	1590
29046	214	2000	1900	1800	1730	1660
29069	216	1500	1450	1400	1350	1300
30007	222	4000	3540	3180	2880	2640
30015	225	4000	3685	3420	3185	2985
30023	227	4000	3700	3440	3210	3015
30034	231	4000	3780	3585	3400	3240
30046	267	4000	3820	3655	3500	3365
30069	278	3000	2895	2795	2700	2615
31007	—	8000	7030	6270	5660	5155
31015	—		7290	6695	6190	5755
31023	—		7395	6880	6425	6030
31034	—		7555	7160	6800	6475

VOLTAGE RATING INDEX

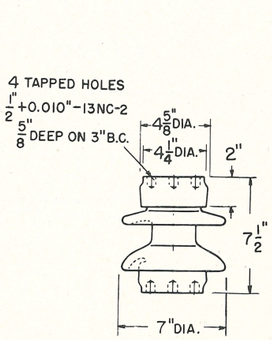
ASA Standard Units shown in bold type.

VOLTAGE RATING KV	STANDARD STRENGTH			HIGH STRENGTH			EXTRA HIGH STRENGTH		
	LOCKE Catalog Number	T.R. No.	Page No.	LOCKE Catalog Number	T.R. No.	Page No.	LOCKE Catalog Number	T.R. No.	Page No.
7.5	**29007**	**202**	**24**	**30007**	**222**	**26**	31007	—	26
15	**29015**	**205**	**24**	**30015**	**225**	**26**	31015	—	26
23	**29023**	**208**	**24**	**30023**	**227**	**26**	31023	—	26
34.5	**29034**	**210**	**24**	**30034**	**231**	**26**	31034	—	26
46	**29046**	**214**	**24**	30046	267	26			
69	**29069**	**216**	**24**	30069	278	26			

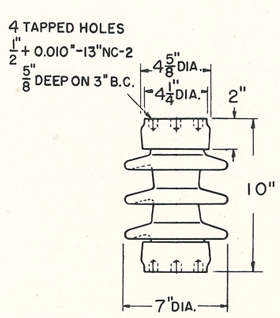
SWITCH AND BUS STATION


STRONG PORCELAIN COLUMN open at bottom only
WIDE HOOD SEPARATIONS improve operation
LARGE PROTECTED LEAKAGE DISTANCE
INTERNAL CAVITY contains active desiccant
PROVEN ADHESIVE of maximum radial length and minimum thickness
GLAZED SAND BAND joins porcelain and cement
GALVANIZED CAP free of defects
NEMA STANDARD TAPPED HOLES in perfect alignment
GALVANIZED STEEL DIAPHRAGM for permanent seal

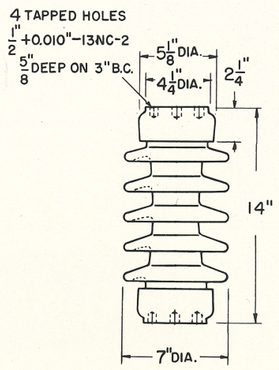
STANDARD STRENGTH
BIL UNITS—ASA STD.
7.5 – 69 KV.



7.5 KV
NO. 29007



15 KV
NO. 29015

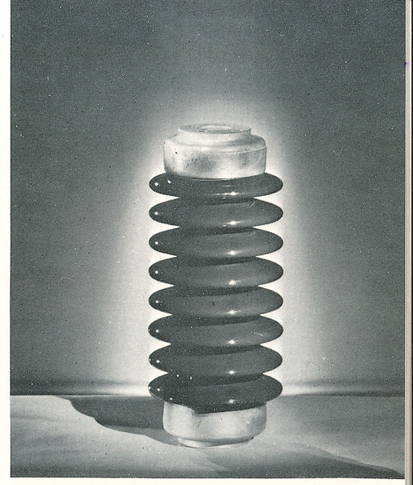


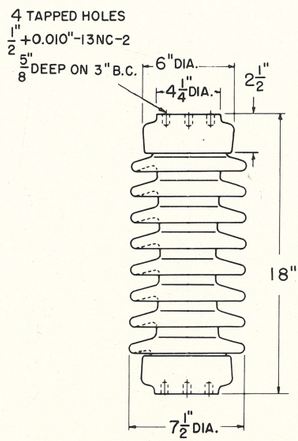
23 KV
NO. 29023

Voltage Rating KV	LOCKE Catalog Number	ASA T. R. No.	Flashover—KV				Withstand Voltage—KV			Radio Influence Voltage	
			Low Frequency		Impulse		Low Frequency		Impulse	Test KV to Ground	Max. MV at 1000 Kc
			Dry	Wet	Pos.	Neg.	Dry 1 Min.	Wet 10 Sec.			
7.5	**29007**	202	60	40	105	120	36	30	95	5	50
15	**29015**	205	85	55	125	200	50	45	110	10	50
23	**29023**	208	110	75	170	250	70	60	150	15	100
34.5	**29034**	210	145	100	225	290	95	80	200	22	100
46	**29046**	214	170	125	280	340	120	100	250	30	200
69	**29069**	216	235	180	390	475	175	145	350	44	200

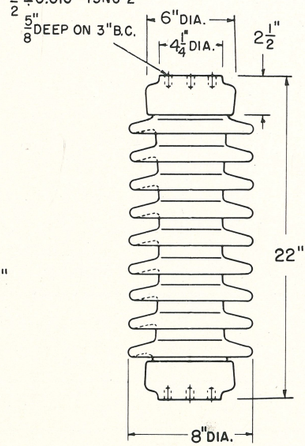
Depth shown for all tapped holes is full thread depth.

INSULATORS
POST TYPE

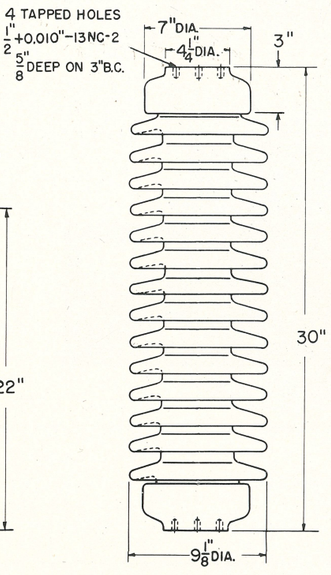




34.5 KV
NO. 29034



46 KV
NO. 29046

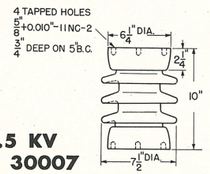


69 KV
NO. 29069

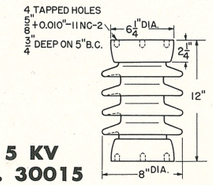
Mechanical Strength				Tension Proof Test Load Lbs.	Leakage Distance Inches	Dry Arcing Distance Inches	Weight Each—Lbs.		Std. Pkg. Quan.	LOCKE Catalog Number	Voltage Rating KV
Cantilever Lbs.	Tension Lbs.	Torsion In—Lbs.	Comp. Lbs.				Net	Pkd.			
2000	5000	6000	10000	1250	10½	6	16	17½	6	**29007**	7.5
2000	5000	7000	10000	1250	15½	7¼	20	19½	4	**29015**	15
2000	5000	8000	10000	1250	24	10½	30	34½	2	**29023**	23
2000	7000	10000	15000	1750	37	14½	49	57½	2	**29034**	34.5
2000	8000	12000	15000	2000	43	17	71	78	1	**29046**	46
1500	12000	15000	25000	2000	72	26	102	113	1	**29069**	69

SWITCH AND BUS STATION

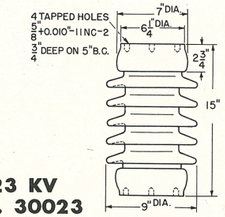
HIGH STRENGTH
BIL UNITS—ASA STD.
7.5 – 69 KV.



7.5 KV
NO. 30007

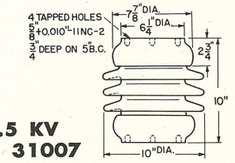


15 KV
NO. 30015

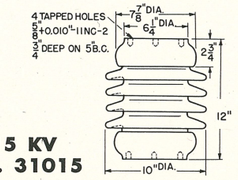


23 KV
NO. 30023

EXTRA HIGH STRENGTH
BIL UNITS
7.5 – 34.5 KV.



7.5 KV
NO. 31007



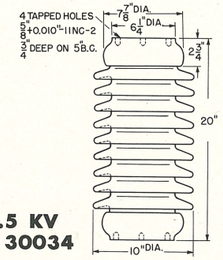
15 KV
NO. 31015

Voltage Rating KV	LOCKE Catalog Number	T.R. No.	Standard Approval	Flashover—KV				Withstand Voltage—KV			Radio Influence Voltage	
				Low Frequency		Impulse		Low Frequency		Impulse	Test KV to Ground	Max. MV at 1000 Kc
				Dry	Wet	Pos.	Neg.	Dry 1 Min.	Wet 10 Sec.			
HIGH												
7.5	**30007**	222	ASA	60	40	105	120	36	30	95	5	50
15	**30015**	225	ASA	85	55	125	200	50	45	110	10	50
23	**30023**	227	ASA	110	75	170	250	70	60	150	15	100
34.5	**30034**	231	ASA	145	100	225	290	95	80	200	22	100
46	**30046**	267	NEMA	170	125	280	340	120	100	250	30	200
69	**30069**	278	NEMA	235	180	390	475	175	145	350	44	200
EXTRA HIGH												
7.5	**31007**	—	—	60	40	105	120	36	30	95	5	50
15	**31015**	—	—	85	55	125	200	50	45	110	10	50
23	**31023**	—	—	110	75	170	250	70	60	150	15	100
34.5	**31034**	—	—	145	100	225	290	95	80	200	22	100

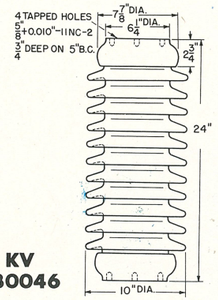
Depth shown on all tapped holes is full thread depth.

INSULATORS

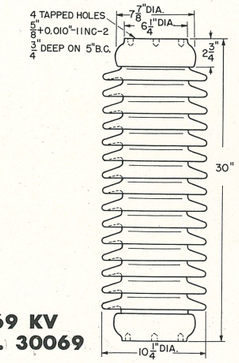
POST TYPE



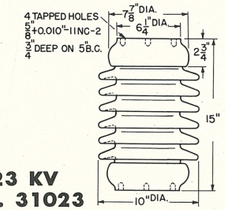
34.5 KV
NO. 30034



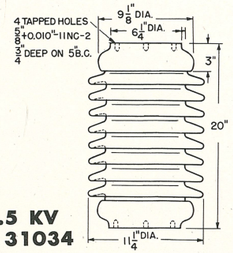
46 KV
NO. 30046



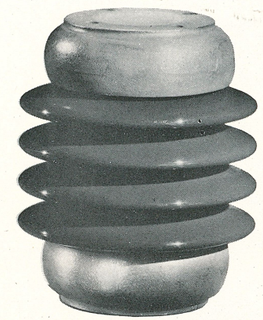
69 KV
NO. 30069



23 KV
NO. 31023



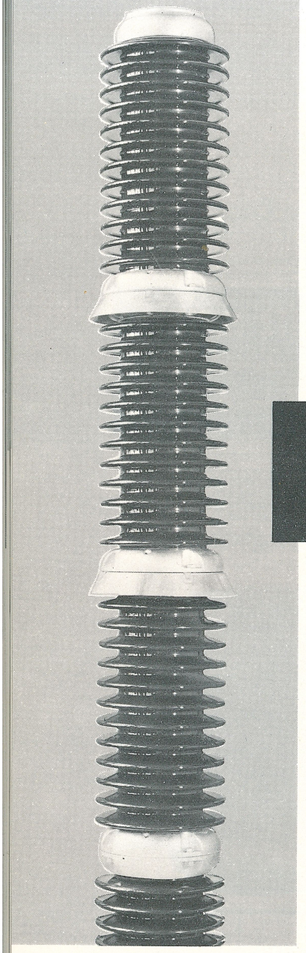
34.5 KV
NO. 31034



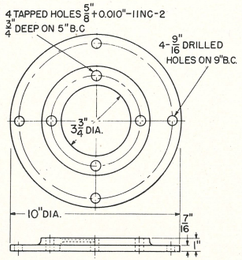
Mechanical Strength				Tension Proof Test Load Lbs.	Leakage Distance Inches	Dry Arcing Distance Inches	Weight Each—Lbs.		Std. Pkg. Quan.	LOCKE Catalog Number	Voltage Rating RV
Cantilever Lbs.	Torsion In.—Lbs.	Tension Lbs.	Comp. Lbs.				Net	Pkd.			
STRENGTH											
4000	12000	10000	20000	2000	10½	6	32	37	2	**30007**	7.5
4000	14000	10000	20000		15½	7¼	37	43	2	**30015**	15
4000	16000	10000	20000		24	10½	58	65	1	**30023**	23
4000	20000	14000	30000		37	14½	85	75	1	**30034**	34.5
4000	20000	15000	30000		43	17	97	110	1	**30046**	46
3000	40000	20000	60000		72	26	125	140	1	**30069**	69
STRENGTH											
8000	40000	28000	40000	2000	10½	6	52	57	1	**31007**	7.5
					15½	7¼	60	67		**31015**	15
					24	10½	85	95		**31023**	23
					37	14½	135	145		**31034**	34.5

SWITCH AND BUS STATION

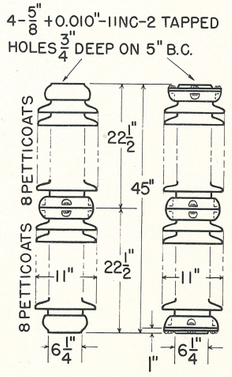
STACKING UNITS
STANDARD STRENGTH
550 – 1050 BIL



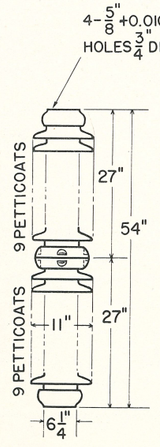
TYPE A



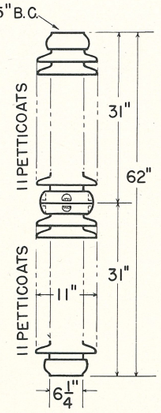
DETAIL OF ADAPTER PLATE TYPE B



550 BIL
NO. 29710 TYPE A
NO. 29810 TYPE B



650 BIL
NO. 29720

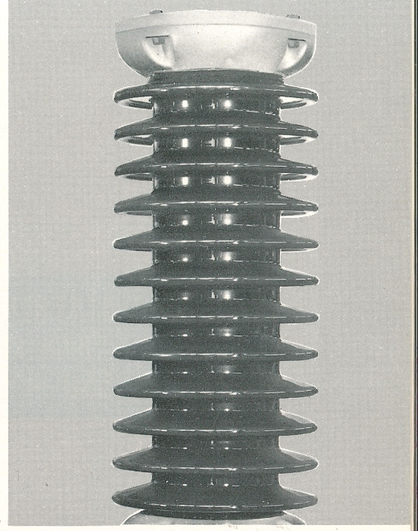


750 BIL
NO. 29730

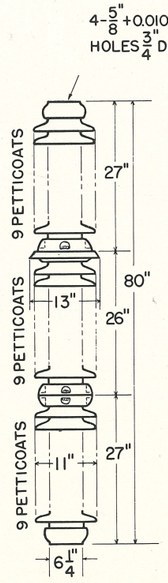
BIL Impulse Withstand Voltage KV	LOCKE Catalog Number		No. of Units in Stack	Suggested KV Rating	Proposed ASA Stack T.R. No.	Height Inches	Flashover—KV				Low Frequency Withstand Voltage—KV		Radio Influence Voltage	
	Type A	Type B					Low Frequ.		Impulse				Test KV to Ground	Max. MV at 1000 Kc
							Dry	Wet	Pos.	Neg.	Dry 1 Min.	Wet 10 Sec.		
550	**29710**	**29810**	2	115	286	45	385	285	610	780	280	230	73	200
650	**29720**	**29820**	2	138	288	54	435	335	710	900	335	275	88	200
750	**29730**	**29830**	2	138/161	291	62	485	380	810	1020	385	315	103	500
900	**29740**	**29840**	3	196	304	80	575	475*	1010	1240	465	385*	125	500
1050	**29750**	**29850**	3	230	312	92	660	570*	1210	1450	545	455*	146	500

*Wet flashover and wet withstand ratings are based on the use of rainshields.

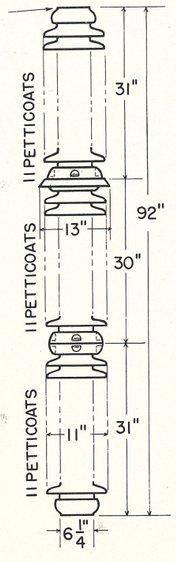
INSULATORS
POST TYPE



TYPE B



900 BIL
NO. 29740

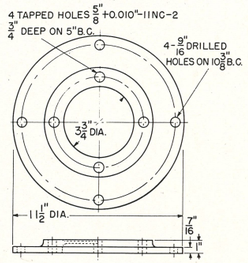


1050 BIL
NO. 29750

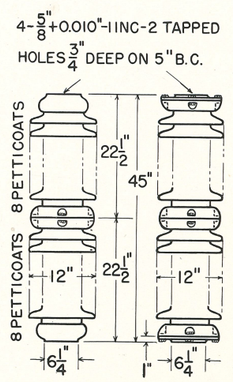
Mechanical Strength				Leakage Dist. In.	Dry Arc. Dist. In.	Lbs. Each		No. of Units in Stack	LOCKE Catalog Number		BIL Impulse Withstand Voltage KV
Cantilever Lbs.	Torsion In.—Lbs.	Tension Lbs.	Compression Lbs.			Net	Pkd.		Type A	Type B	
1700	40000	20000	60000	99	39	210	240	2	**29710**	**29810**	550
1450				116	45	250	290	2	**29720**	**29820**	650
1200				132	51	280	330	2	**29730**	**29830**	750
910				165	64	375	435	3	**29740**	**29840**	900
750				198	76	420	495	3	**29750**	**29850**	1050

SWITCH AND BUS STATION

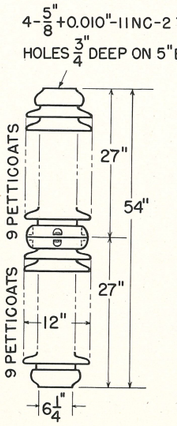
STACKING UNITS
HIGH STRENGTH
550 — 1470 BIL



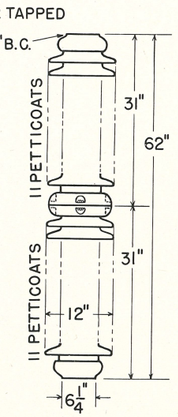
DETAIL OF ADAPTER PLATE TYPE B



550 BIL
NO. 30710 TYPE A
NO. 30810 TYPE B



650 BIL
NO. 30720

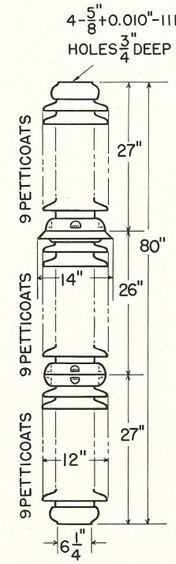


750 BIL
NO. 30730

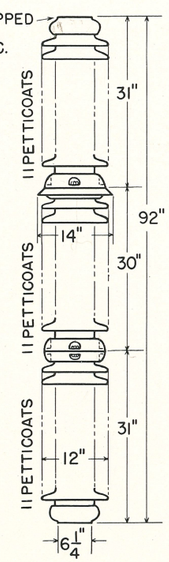
BIL Impulse Withstand Voltage KV	LOCKE Catalog Number		No. of Units in Stack	Suggested KV Rating	Proposed ASA Stack T.R. No.	Height Inches	Flashover—KV				Low Frequency Withstand Voltage—KV		Radio Influence Voltage	
	Type A	Type B					Low Frequ.		Impulse				Test KV to Ground	Max. MV at 1000 Kc
							Dry	Wet	Pos.	Neg.	Dry 1 Min.	Wet 10 Sec.		
550	**30710**	**30810**	2	115	287	45	385	285	610	780	280	230	73	200
650	**30720**	**30820**	2	138	289	54	435	335	710	900	335	275	88	200
750	**30730**	**30830**	2	138/161	295	62	485	380	810	1020	385	315	103	500
900	**30740**	**30840**	3	196	308	80	575	475*	1010	1240	465	385*	125	500
1050	**30750**	**30850**	3	230	316	92	660	570*	1210	1450	545	455*	146	500
1300	**30760**	**30860**	4	287	324	106	745	660*	1410	1650	610	525*	180	1000
1470	**30770**	**30870**	4	345	330	122	830	740*	1610	1850	680	590*	210	1000

*Wet flashover and wet withstand ratings are based on the use of rainshields.

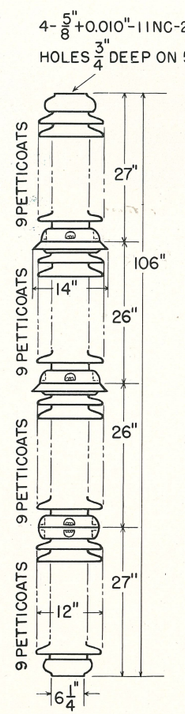
INSULATORS
POST TYPE



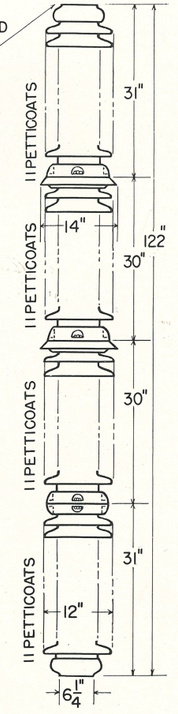
900 BIL
NO. 30740



1050 BIL
NO. 30750



1300 BIL
NO. 30760

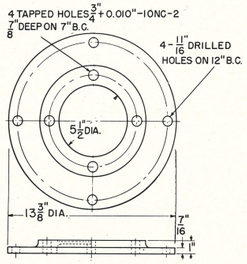


1470 BIL
NO. 30770

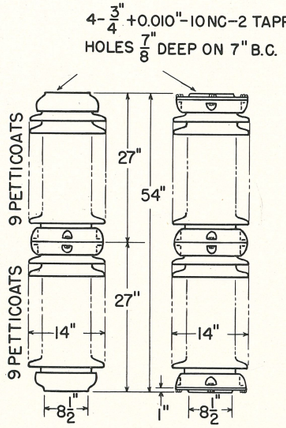
Mechanical Strength				Leakage Dist. In.	Dry Arc. Dist. In.	Lbs. Each		No. of Units in Stack	LOCKE Catalog Number		BIL Impulse Withstand Voltage KV
Cantilever Lbs.	Torsion In.—Lbs.	Tension Lbs.	Compression Lbs.			Net	Pkd.		Type A	Type B	
2900	90000	25000	75000	99	39	240	280	2	**30710**	**30810**	550
2450				116	45	285	335	2	**30720**	**30820**	650
2000				132	51	330	390	2	**30730**	**30830**	750
1450				165	64	425	495	3	**30740**	**30840**	900
1170				198	76	495	615	3	**30750**	**30850**	1050
1000				231	90	560	660	4	**30760**	**30860**	1300
900				264	102	660	780	4	**30770**	**30870**	1470

SWITCH AND BUS STATION

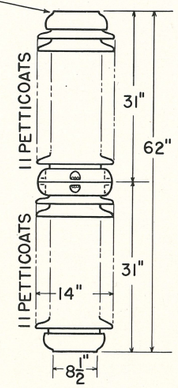
STACKING UNITS
EXTRA HIGH STRENGTH
650 — 1470 BIL



DETAIL OF ADAPTER PLATE TYPE B



650 BIL
NO. 31720 TYPE A
NO. 31820 TYPE B



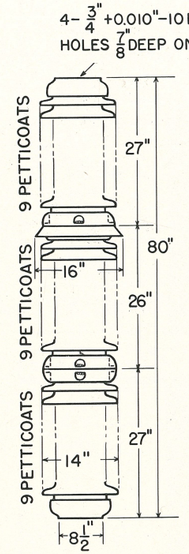
750 BIL
NO. 31730

BIL Impulse Withstand Voltage KV	LOCKE Catalog Number		No. of Units in Stack	Suggested KV Rating	Height Inches	Flashover—KV				Low Frequency Withstand Voltage—KV		Radio Influence Voltage	
	Type A	Type B				Low Frequ.		Impulse				Test KV to Ground	Max. MV at 1000 Kc
						Dry	Wet	Pos.	Neg.	Dry 1 Min.	Wet 10 Sec.		
650	31720	31820	2	138	54	435	335	710	900	335	275	88	200
750	31730	31830	2	138/161	62	485	380	810	1020	385	315	103	500
900	31740	31840	3	196	80	575	475*	1010	1240	465	385*	125	500
1050	31750	31850	3	230	92	660	570*	1210	1450	545	455*	146	500
1300	31760	31860	4	287	106	745	660*	1410	1650	610	525*	180	1000
1470	31770	31870	4	345	122	830	740*	1610	1850	680	590*	210	1000

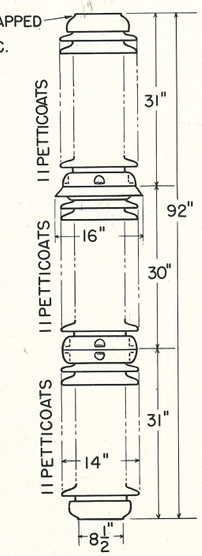
*Wet flashover and wet withstand ratings are based on the use of rainshields.

INSULATORS

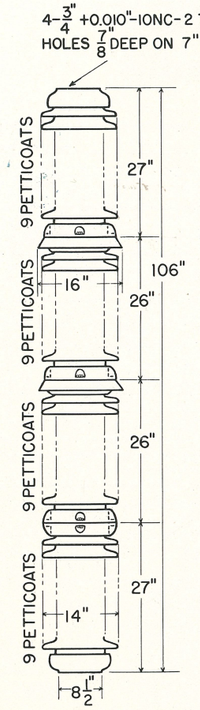
POST TYPE



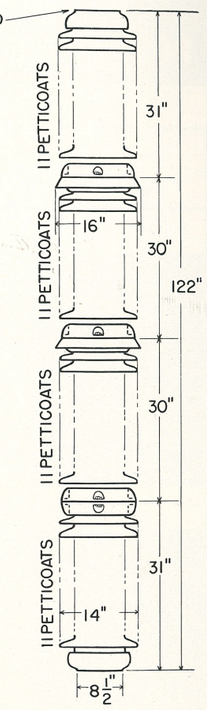
900 BIL
NO. 31740



1050 BIL
NO. 31750



1300 BIL
NO. 31760



1470 BIL
NO. 31770

Mechanical Strength				Leakage Dist. In.	Dry Arc. Dist. In.	Lbs. Each		No. of Units in Stack	LOCKE Catalog Number		BIL Impulse Withstand Voltage KV
Cantilever Lbs.	Torsion In.—Lbs.	Tension Lbs.	Compression Lbs.			Net	Pkd.		Type A	Type B	
4100	120000	40000	100000	116	45	400	460	2	31720	31820	650
3500				132	51	500	570	2	31730	31830	750
2750				165	64	600	690	3	31740	31840	900
2300				198	76	750	855	3	31750	31850	1050
2000				231	90	800	920	4	31760	31860	1300
1750				264	102	1000	1140	4	31770	31870	1470

SWITCH AND BUS
STATION POST TYPE

STACKING POST INSULATORS

LOCKE CATALOG NUMBERS					
Stack Type A	Top Unit	Center Unit	Bottom Unit	Stack Type B	All Units
STANDARD STRENGTH					
29710	29711	—	29712	**29810**	29713
29720	29721	—	29722	**29820**	29723
29730	29731	—	29732	**29830**	29733
29740	29721	29723	29722	**29840**	29723
29750	29731	29733	29732	**29850**	29733
HIGH STRENGTH					
30710	30711	—	30712	**30810**	30713
30720	30721	—	30722	**30820**	30723
30730	30731	—	30732	**30830**	30733
30740	30721	30723	30722	**30840**	30723
30750	30731	30733	30732	**30850**	30733
30760	30721	30723	30722	**30860**	30723
30770	30731	30733	30732	**30870**	30733
EXTRA HIGH STRENGTH					
31720	31721	—	31722	**31820**	31723
31730	31731	—	31732	**31830**	31733
31740	31721	31723	31722	**31840**	31723
31750	31731	31733	31732	**31850**	31733
31760	31721	31723	31722	**31860**	31723
31770	31731	31733	31732	**31870**	31733

INSULATORS
COMPARATIVE CATALOG NUMBERS

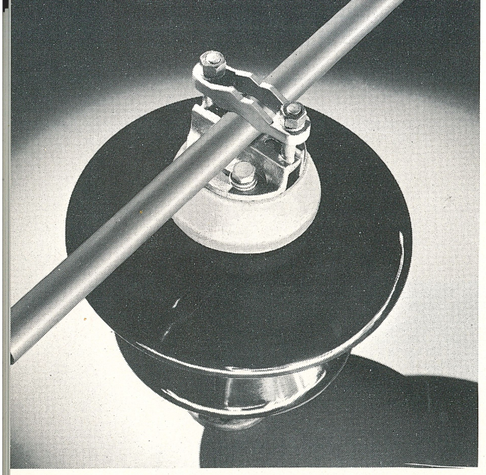
CAP AND PIN TYPE

T.R. NO.	DESIGN*	LOCKE	O.B.	LAPP	PINCO	A. B. CHANCE	THOMAS	I-T-E	WGHSE
140	S	**7785**	31152	7290	735	69134	13074	729	545512
145	H	**8888**	33560	23319	750	6815	13057	706	678828
141	H	**23082**	30575	9080	6095	—	—	730	1123729
142	H	**23083**	30577	9099	6097	—	—	731	845688
139	H	**23333**	43990	—	—	—	—	—	—
13	S	**29153**	37746	27069	6046	68146	13846	705	1176230
1	S	**29200**	37708	27075	6075	67107	13808	740	968771
4	S	**29250**	37715	27073	6015	68115	13815	741	968768
7	S	**29251**	37723	25436	6023	68123	13823	742	968769
10	S	**29455**	37734	27071	6034	68134	13835	744	968770
147	S	**29511**	37769	24322	6069	68169	13869	724	1176190
53	H	**30153**	38750	30701	850	78146	—	—	—
41	H	**30200**	38710	30696	—	78107	—	—	—
44	H	**30250**	38720	30698	—	78115	—	—	1295355
46	H	**30251**	34340	25554	891	6928	13279	707	1176130
49	H	**30455**	35190	30700	—	78134	—	—	1176131
—	E	**31444**	—	—	—	—	—	—	—
58	H	**32200**	34749	—	—	—	—	—	—

STATION POSTS

T.R. NO.	DESIGN*	LOCKE	O.B.	LAPP	T.R. NO.	DESIGN*	LOCKE	O.B.	LAPP
NON-STACKING									
202	S	**29007**	36375	10470	227	H	**30023**	41515	34247
205	S	**29015**	36310	27077	231	H	**30034**	41520	34248
208	S	**29023**	36314	25565	267	H	**30046**	41524	34249
210	S	**29034**	36318	9785	278	H	**30069**	41530	34250
214	S	**29046**	36322	25567	—	E	**31007**	41010	34534
216	S	**29069**	36330	9521A	—	E	**31015**	41012	34535
222	H	**30007**	41510	34245	—	E	**31023**	41015	34536
225	H	**30015**	41512	34246	—	E	**31034**	41020	34537
STACKING									
286	S	**29710**	47801	24760	286	S	**29810**	47901	—
288	S	**29720**	47802	50908	288	S	**29820**	47902	—
291	S	**29730**	47803	51161	291	S	**29830**	47903	—
304	S	**29740**	47805	50742	304	S	**29840**	47905	—
312	S	**29750**	47807	50637	312	S	**29850**	47907	—
287	H	**30710**	47821	54794	287	H	**30810**	47921	—
289	H	**30720**	47822	52591	289	H	**30820**	47922	—
295	H	**30730**	47823	52161	295	H	**30830**	47923	—
308	H	**30740**	47825	51688	308	H	**30840**	47925	—
316	H	**30750**	47827	50439	316	H	**30850**	47927	—
324	H	**30760**	47831	51606	324	H	**30860**	47931	—
330	H	**30770**	47833	51560	330	H	**30870**	47933	—
—	E	**31720**	47842	—	—	E	**31820**	47942	—
—	E	**31730**	47843	53161	—	E	**31830**	47943	—
—	E	**31740**	47845	51202	—	E	**31840**	47945	—
—	E	**31750**	47847	51689	—	E	**31850**	47947	—
—	E	**31760**	47851	53142	—	E	**31860**	47951	—
—	E	**31770**	47853	53143	—	E	**31870**	47953	—

*S—Standard Strength, H—High Strength, E—Extra High Strength.



SWITCH AND BUS
OUTDOOR BUS

APPLICATION OF OUTDOOR BUS CLAMPS AND FITTINGS

Conductor fittings and adapters for assembly with Locke outdoor switch insulators are used for all accepted methods of mounting outdoor bus and conductor supports—upright, horizontal or underhung.

CONDUCTOR FITTINGS

Generally, listed fittings consist of base and keeper. The base is the part firmly attached to the insulator or to an adapter placed between the unit and the conductor fitting. The keeper is the movable part which holds the conductor to the base. Two-clamp conductor fittings for conductor bars are provided with two keepers.

Keepers are made of non-magnetic material to reduce the heating effect of the magnetic field at the point of support. Bases are made of non-magnetic material or of malleable iron, hot-dip galvanized.

To permit angular adjustment of the conductor, bases of fittings for round conductors have slots for the holding bolts.

The bolts furnished with all non-magnetic fittings are Everdur, except when otherwise noted. Those furnished with "half-non-magnetic" fittings are steel, hot-dip galvanized. The bolts which secure the keeper to its base are square-headed and fit into a channel shaped section of the lower fitting. Cap screws or bolts are furnished to secure the base to the insulator.

MOUNTING ATTACHMENTS

Listed spacers and pipe adapters are made of malleable iron, hot-dip galvanized. Pipe adapters are of the two-bolt type and have serrated gripping surfaces to prevent turning of the adapter on the pipe.

APPLICATION

To protect bus support insulators from damage by excessive cantilever loads due to dimensional changes of the bus, bus runs should be clamped tight at one point of support only. Clamps at other supporting points should permit the bus to slide freely. Where the length of the bus warrants support at its center, in addition to its ends, the bus should be clamped firmly only at the center to permit expansion in either direction. Long bus runs should be divided into sections with suitable expansion joints.

ORDERING DIRECTIONS

Order by Catalog Number.

For reamed-to-size fittings for round conductors, specify outside conductor diameter.

For fittings for rectangular bars, specify the number of bars to be mounted.

INSULATORS
CLAMPS AND FITTINGS

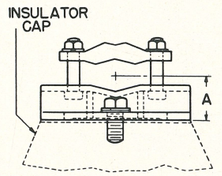
FOR CLAMPING OF PIPE AND BARE STRAND

For attaching round bus or conductor to top or bottom of insulator units in assembly of outdoor bus supports.

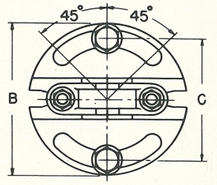
On underhung posts use upright bus clamp with cap screws either end.

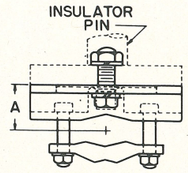
The top of the fittings is made of nonferrous material, which materially reduces the heating effect of the magnetic field at the point of support. The base of all fittings is made of nonferrous material or of galvanized malleable iron.

Bolts furnished with the all-nonmagnetic fittings are Everdur. Those furnished with the half-nonmagnetic fittings are hot-dip galvanized steel.



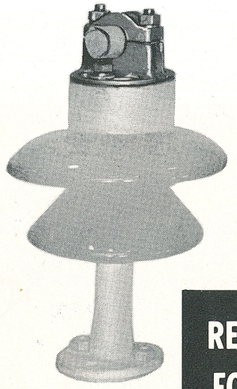
UPRIGHT





UNDERHUNG

	Conductor Size			Catalog Numbers				Dimensions—In.			Ship. Wt. Ea. Lbs.
				Half Nonmagnetic		All Nonmagnetic					
	I. P. S. Tubing Inches	Max. O. D. Inches	Bare Cable MCM	For Upright Insulators	For Underhung Insulators	For Upright Insulators	For Underhung Insulators	A	B	C	
For insulators with 3 inch Bolt Circle	—	.580	250	6026206G1	6026206G9	6052744G1	6052744G9	1 3/8	4 1/4	3	3
	1/2	.840	500	6026206G3	6026206G11	6052744G3	6052744G11	1 1/2	4 1/4	3	3
	3/4	1.050	750	6026206G4	6026206G12	6052744G4	6052744G12	1 5/8	4 1/4	3	3
	1	1.315	1250	6026206G5	6026206G13	6052744G5	6052744G13	1 3/4	4 1/4	3	4
	1 1/4 to 1 1/2	1.900	2000	6026206G6	6026206G14	6052744G6	6052744G14	2 1/8	4 1/4	3	4
	2	2.375	—	6026206G7	6026206G15	6052744G7	6052744G15	2 3/8	4 1/4	3	4
	2 1/2	2.875	—	6026206G8	6026206G16	6052744G8	6052744G16	2 5/8	4 1/4	3	5
For insulators with 5 inch Bolt Circle	—	.580	250	6026206G17	6026206G28	6052744G17	6052744G28	1 3/8	6 1/4	5	7
	1/2	.840	500	6026206G19	6026206G30	6052744G19	6052744G30	1 3/4	6 1/4	5	7
	3/4	1.050	750	6026206G20	6026206G31	6052744G20	6052744G31	1 7/8	6 1/4	5	7
	1	1.315	1250	6026206G21	6026206G32	6052744G21	6052744G32	2	6 1/4	5	7
	1 1/4 to 1 1/2	1.900	2000	6026206G22	6026206G33	6052744G22	6052744G33	2 1/4	6 1/4	5	7
	2	2.375	—	6026206G23	6026206G34	6052744G23	6052744G34	2 1/2	6 1/4	5	7
	2 1/2	2.875	—	6026206G24	6026206G35	6052744G24	6052744G35	2 3/4	6 1/4	5	7
	3	3.500	—	OBSOLETE		6052744G25	6052744G36	3 1/8	6 1/4	5	8
	3 1/2	4.000	—	OBSOLETE		6052744G26	6052744G37	3 3/8	6 1/4	5	8
	4	4.500	—	OBSOLETE		6052744G27	6052744G38	3 5/8	6 1/4	5	8



SWITCH AND BUS
OUTDOOR BUS CLAMPS

REAMED TO SIZE FITTINGS FOR ROUND CONDUCTORS

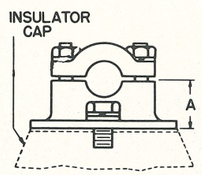
For attaching round bus or conductors to top or bottom of insulator units in assembly of outdoor bus supports.

On underhung posts use upright bus clamp with cap screws either end.

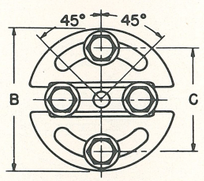
For materials used see previous page.

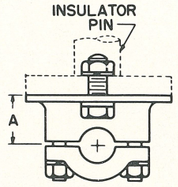
Spacers for slip-fit are included. For clamp-fit, remove them.

When ordering, please specify outside conductor diameter. When ordering for use with aluminum conductors, add suffix "A" to group number.



UPRIGHT





UNDERHUNG

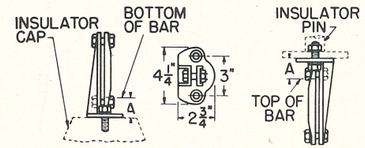
	Conductor Size			Catalog Numbers		Dimensions—Inches			Ship. Wt. Lbs. Each
	I. P. S. Tubing Inches	Max. O. D. Inches	Bare Cable MCM	All Nonmagnetic For Upright Insulators	All Nonmagnetic For Underhung Insulators	A	B	C	
For insulators with 3 inch Bolt Circle	½	.840	500	6129744G1	6129744G6	1½	4¼	3	3
	¾	1.050	750	6129744G2	6129744G7	1 19/32	4¼	3	4
	1	1.315	1200	6129744G3	6129744G8	1 23/32	4¼	3	4
	1¼	1.660	1500	6129744G4	6129744G9	1 29/32	4¼	3	5
	1½	1.900	2000	6129744G5	6129744G10	2	4¼	3	5
	2	2.375	—	6129747G1	6129747G5	2¼	4¼	3	6
	2½	2.875	—	6129747G2	6129747G6	2½	4¼	3	6
	3	3.500	—	6129747G9	6129747G11	2 7/8	4¼	3	7
	3½	4.000	—	6187174G1	6187174G5	3⅛	4¼	3	8
	4	4.500	—	6187174G2	6187174G6	3⅜	4¼	3	9
For insulators with 5 inch Bolt Circle	½	.840	500	6129746G1	6129746G6	1 11/16	6¼	5	5
	¾	1.050	750	6129746G2	6129746G7	1 25/32	6¼	5	6
	1	1.315	1250	6129746G3	6129746G8	1 29/32	6¼	5	6
	1¼	1.660	1500	6129746G4	6129746G9	2 3/32	6¼	5	7
	1½	1.900	2000	6129746G5	6129746G10	2 3/16	6¼	5	8
	2	2.375	—	6129747G3	6129747G7	2 7/16	6¼	5	9
	2½	2.875	—	6129747G4	6129747G8	2 11/16	6¼	5	10
	3	3.500	—	6129747G10	6129747G12	3	6¼	5	10
	3½	4.000	—	6187174G3	6187174G7	3¼	6¼	5	11
	4	4.500	—	6187174G4	6187174G8	3½	6¼	5	11

INSULATORS
OUTDOOR BUS CLAMPS

FOR RECTANGULAR BARS

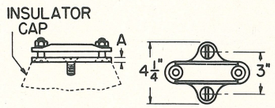
For attaching rectangular bus bars or conductors to top or bottom of insulator units in assembly of outdoor bus supports.
With the single-clamp type, a maximum of three ¼" bars is recommended. With the two-clamp type, a maximum of six ¼" bars is recommended, three per clamp with wide center fitting. Catalog number includes bolts for only one ¼" bar per clamp. To obtain bolts of proper length, specify number of bars on your order. No spacers are included for mounting between bus laminations. When required, add ¼" spacers.

FOR BARS ON EDGE — **SINGLE CLAMP** — **FOR FLAT BARS**

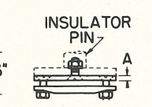


Upright

Underhung

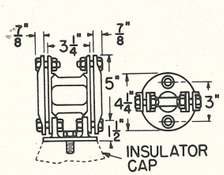


Upright

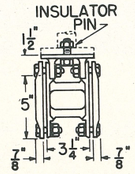


Underhung

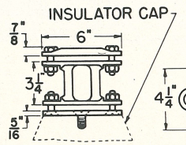
TWO CLAMP



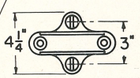
Upright

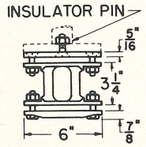


Underhung



Upright





Underhung

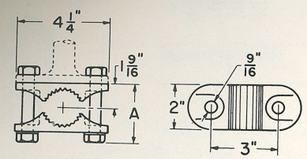
Type	Size of Conductor Bar Inches	Catalog Number Half—Nonmagnetic For Upright Insulators	Half—Nonmagnetic For Underhung Insulators	All—Nonmagnetic For Upright Insulators	All—Nonmagnetic For Underhung Insulators	A In.	Approx. Ship. Wt. Lbs. Each
Single Clamp		For Bars on Edge					
	2 x ¼	6159600G1	6159600G2	6159601G1	6159601G2	1½	4
	3 x ¼	6159600G3	6159600G4	6159601G3	6159601G4	1½	4
	4 x ¼	6159600G5	6159600G6	6159601G5	6159601G6	1½	4
		For Flat Bars					
	2 x ¼	6159602G1	6159602G2	6159603G1	6159603G2	½	4
	3 x ¼	6159602G3	6159602G4	6159603G3	6159603G4	½	4
	4 x ¼	6159602G5	6159602G6	6159603G5	6159603G6	½	4
Two Clamp		For Bars on Edge					
	4 x ¼	6159604G1	6159604G2	6159605G1	6159605G2	—	8
		For Flat Bars					
	4 x ¼	6159606G1	6159606G2	6159607G1	6159607G2	—	6

SWIT[illegible] AND BUS [illegible]ERS AND SPACERS

PIPE ADAPTERS

Used in mounting insulator stacks at the support end.

Catalog Number	Bolt Circle Size of Attachment	Ship. Weight Lbs.
7791	5-in. Top and 8¼-in. Bottom	15½
27423	7 in. Top and 10½ in. Bottom	22



For mounting 3- inch bolt circle insulators on 1¼ or 2 inch pipe.

Pipe Size Inches	Catalog Numbers		A Inches	Ship. Wt. Each Lb.
	For Upright or Horizontal Mounting	For Underhung Mounting		
1¼	6026203 G1	6026203 G3	3¼	3
2	6026203 G2	6026203 G4	4	3

SPACERS

Used to obtain additional clearances.

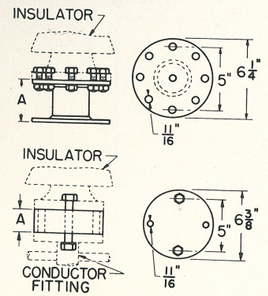


Fig. 1

Fig. 2

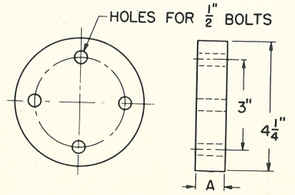


Fig. 3

Catalog Number	Fig. No.	Bolt Circle Size of Attachment, Inches. Top and Bottom	A In.	Approx. Ship. Wt. Lbs.
6179647G1	1	5	3½	10
6026215G2	2	5	2¼	6
1883588PT5	3	3	1	1½
1883588PT11	3	3	2	3
1883588PT9	3	3	2½	4

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